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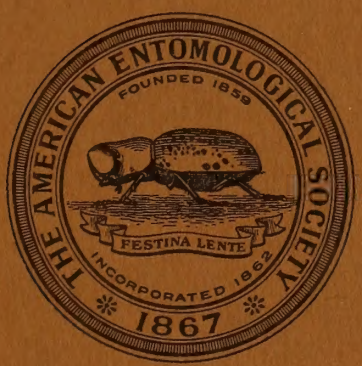
ELACHISTIDAE
OF
NORTH AMERICA
(MICROLEPIDOPTERA)

BY

ANNETTE F. BRAUN



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ELACHISTIDAE of NORTH AMERICA

(MICROLEPIDOPTERA)

BY ANNETTE F. BRAUN
Cincinnati, Ohio

INTRODUCTION

The family Elachistidae as at present restricted, contains 25 to 30 genera, distributed in all parts of the world. However the majority of the known species are found in North Temperate regions.

The relationships of the family are somewhat obscure. The presence of an additional branch of radius of the hind wing in some of the genera suggests primitive affinities; however the retention of such a character in some members of a group is not inconsistent with a high degree of specialization of the group as a whole.[1] Neither pupal characters nor genitalia bear out the assumption of a primitive position for the family. Pupal characters indicate Gelechioid affinities with relationship closer to the Oecophoridae, a view supported by certain features of the genitalia. Meyrick (1927, Revised Handbook of British Lepidoptera, p. 600) derives the family from Hyponomeutoid stock; this view is supported by imaginal structure. I would derive the family from primitive Hyponomeutoid stock, in which there is a tendency for preservation of additional branches of the radial sector of the hind wing (Braun

[1] Compare the family Gracilariidae, in which the primitive members show a branched radial sector of the hind wing, the more advanced members extreme specialization in vein reduction and in larval structure.

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1933, Trans. Amer. Ent. Soc., LIX, p. 245), with development proceeding along Gelechioid lines, but along the Oecophorid rather than the Gelechiid branch, with considerable affinity to the Scythridae.

The group of genera herein treated comprises the North American representatives of the family. Seven genera are recognized, of which two are described as new. A total of fifty-seven species are included in the family, of which 48 belong in *Elachista*. Eighteen new species are described, sixteen of which are placed in *Elachista*.

Of the species listed in McDunnough's Check List of the Lepidoptera of Canada and the United States of America, Part II, Microlepidoptera (1939) under the Elachistidae, the following are excluded from the family in the present treatment: *bicristatella* Chambers (No. 9008), *concolorella* Chambers (No. 9011), *inornatella* Chambers (No. 9013), *metallifera* Walsingham (No. 9018), and *orichalcella* Clemens (No. 9019), all of which are Cosmopterygids; *texanella* Chambers, which is a Scythrid. *Aphigalia* (*Phigalia*) *ochremaculella* Chambers is omitted as an unrecognized species, probably not Elachistid.

In addition to my own collection (approximately 500 specimens) which includes much reared material and is the source of all the data here given on early stages and larval habits, I have received for study specimens from several other collections. Material from the Canadian National Collection, submitted by Dr. J. McDunnough, contains representatives of several little-known species, and a number of new species, eight of which are based only on material from this collection. To Mr. Carl Heinrich I am indebted for many courtesies and for the loan of material from the United States National Museum, which has yielded a number of new species, valuable distributional data, and has enabled recognition of hitherto doubtful or unknown species. From the authorities of the Museum of Comparative Zoology, from Dr. Frank M. Jones of Wilmington, Delaware, from Dr. E. P. Darlington of New Lisbon, New Jersey, and Dr. J. R. Eyer, State College, New Mexico, I have received material for study, and to them my thanks are also due.

All figures were drawn by the writer, except the seta map of the larva of *Elachista albicapitella* (furnished by Alvah Peterson) and the figures of the venation and the female genitalia of *Elachista patriodoxa* from the type in the British Museum (by J. F. Gates Clarke). In the case of the genitalia, the figures of the new species were made from

slides of the holotype and allotype, or from paratypes of the same series. All of the male genitalia are drawn to the same scale, except *Elachista radiantella, solitaria and praelineata,* and *Dicranoctetes brachyelytrifoliella,* in which the magnification is one and one-half that of the others. The magnification of the figures of the female genitalia is one-half that of the male. All figures of venation (except the small figure of *Stephensia brunnichiella*) are drawn to the same scale (approximately × 15). In the case of the other figures the magnification is indicated in the explanation of plates, when necessary.

Abbreviations used in the text in referring to location of material are as follows: A. F. B. Coll. (A. F. Braun Collection), A. N. S. P. (Academy of Natural Sciences of Philadelphia), B. M. (British Museum), C. N. Coll. (Canadian National Collection), M. C. Z. (Museum of Comparative Zoology), U. S. N. M. (United States National Museum).

In listing the material from collections other than that of the author, the data in most instances are quoted as they appear on the locality labels, without attempt at interpretation.

Characters of the Family

The characterization of the family as here given will include exotic as well as American genera.[2]

Head usually smooth, rarely rough-scaled, side tufts sometimes roughened. Tongue present, scaled at base; absent in a few exotic genera. Labial palpi very short to moderately long, slender, curved, porrected or drooping, smooth or with the second segment slightly thickened or loosely scaled toward apex, third segment variable in length, shorter than the second, or rarely as long or longer, pointed. Maxillary palpi minute, rudimentary or absent. Antennae shorter than the fore wings, basal segment usually with pecten, stalk with two whorls of scales to a segment, sometimes somewhat thickened in the male or rarely ciliated. Ocelli present or absent. Posterior tibiae normally with long hairs above or with long hairs above and below, or rarely with rough hair-scales above and below, or entirely smooth. First pair of spurs of the posterior tibiae usually before the middle, rarely beyond, but the position may be somewhat variable within a genus.

Fore wings elongate, acute, rarely with scale tufts. Subcostal retinaculum present in males (the usual frenulum hook); subdorsal retinaculum present

[2] It does not however cover such aberrant forms as *Eretmograptis* Meyrick, described from the Belgian Congo (Parc National Albert).

sometimes in both sexes, but its function taken over by a subcostal retinaculum in males and in the more specialized females.

All branches of R, M, and Cu present in the primitive forms; vein reduction brought about by the coalescence of one or more branches of media with adjacent veins, and the coalescence of R_4 and R_5. R_4 and R_5 stalked or coincident (or rarely separate), R_5 to costa; R_3 sometimes connate or short-stalked with R_{4+5}. M_1 separate (in primitive forms), or out of the stalk of R_{4+5} or out of R_5 beyond R_4, or rarely lost; M_3 coalescing with Cu_{1a}; finally M_2 lost, or rarely R_4, R_5, M_1, M_2 and $M_3 + Cu_{1a}$ all stalked together. Cu_{1a}, Cu_{1b} both strong; Cu_2[3] well preserved distally. Anal Y-vein present, or with the upper fork obsolete.

Hind wings from one-half to three-fourths the width of the fore wings, lanceolate, rarely acuminate, costa usually without well-defined shoulder. Frenulum single-spined in male, two-spined in female. Length of cilia from two to four times the breadth of the wings.

All veins present in primitive forms, with cell closed; cell imperfectly closed or open in reduced forms. $Sc + R_1$ reaching to or beyond middle of costa in primitive forms, short in reduced forms; R_s distant from $Sc + R_1$, extending in a more or less straight line through or near the center of the wing, and often forked near margin; M_1 stalked with R_s (rarely separate); medial stem faintly preserved lying close along side of radius; M_2 usually absent, when present often associated with the radial stem, or arising together with M_3 from the obsolescent medial stem; M_{b} usually associated with the cubital stem or absent; Cu_{1a} and Cu_{1b} present, or Cu_1 reduced to an unbranched vein; Cu_2 weak; $1A + 2A$ forming the anal Y-vein; 3A sometimes distinguishable.

Abdomen sometimes "spined," *i.e.* the tergites bear patches of specialized flattened, strongly sclerotized setae arising from specialized sockets (fig. 2).

Male genitalia symmetrical; uncus present or absent; socii reduced or vestigial; gnathos usually one or sometimes two spined knobs, the knobs sometimes absent, and then gnathos reduced to a band, the fused-at-tip arms; harpe variously formed, broadly attached to vinculum, often with free arm from median area weakly articulating with anellus; cucullus well defined, setose; sacculus well developed, in one group of genera with basal process, in the remaining genera, the process absent or possibly fused with sacculus as indicated by a doubtfully homologous lobe at apex of sacculus; anellus well developed, ventral plate bilobed, membranous dorsally; transtilla rarely present; vinculum bandlike or more or less produced anteriorly; aedeagus with more or less swollen base, entrance of penis dorsal, near the proximal end; cornuti present or absent.

[3] Cubitus is regarded as three-branched, with the primary cubital fork close to the base of the wing; Cu_1 dividing into Cu_{1a} and Cu_{1b} (Cu_1 and Cu_2 respectively in the Comstock-Needham system); Cu_2 is the 1A of the Comstock-Needham system.

"H. Stainton entdeckte die Raupe im April und Mai in den Blättern der Dactylis glomerata." This statement is applicable only to an *Elachista*, as the species of the genus with complete venation are not grass or sedge feeders. Janmoulle (1948, Lambillionea, XLVII, pp. 64-72) rejects *Cycnodia* as null and void, having been based on no real object, but a mixture of two species. For the species with complete venation, *Mendesia* is the oldest available generic name.

Female genitalia: genital plate more or less well differentiated and sclerotized, ostium opening in the mid-line of the genital plate; ductus bursae long or short, straight or coiled, often sclerotized near ostium, sometimes armed with teeth; ductus seminalis arising from ductus bursae, or more rarely from posterior end of bursa copulatrix; bursa copulatrix variously shaped; signum present or absent.

The larvae are miners in leaves rarely in stems; the species of one group of genera are restricted to members of the Gramineae, Cyperaceae and Juncaceae; the species of the remaining genera feed on various dicotyledonous plants. The egg, placed on the surface of the leaf, is usually the primitive, elongate flattened type, rarely semi-erect. The larvae are tissue feeders, hence without extreme modification. The pupa is of the Gelechioid type.

In spite of differences in markings and the great structural differences between the most primitive and the most specialized genera of the family, the moths have a common aspect which assists in placing them in the family. The structure of the head and its appendages, the shape of the hind wing, with R_s extending through or near the center of the wing, and (in our species) the stalking of M_1 with it are the best recognition characters. The species are small, with wing expanse rarely exceeding a half inch, often much less.

But few generalizations on relationships within the family can be made. Primitive genera are almost entirely absent from the American fauna. In one genus only—*Coelopoeta*—are all veins present in both wings, but it appears unrelated to other American genera. In the remaining genera, the evolutionary trend in venation has followed one direction, and venation can not be used as a criterion of relationship as nearly identical venation may occur in genera, which on the basis of genitalic characters belong in different groups. Again, the variation in venation within a genus (*e.g. Elachista*) may be greater than the difference between it and another genus. On genitalic characters, these genera fall into three groups. One of these, *Onceroptila,* belongs in the group with the genera *Mendesia,*[4] *Perittia, Scirtopoda,* etc., the more

[4] *Mendesia* de Joannis is here accepted instead of *Cycnodia* H.-S. Herrich-Schaeffer (1853, Syst. Bearb. Schmett. Eur., v, pp. 46, 47, p. 211, pl. XIII, figs. 13, 14) proposed *Cycnodia,* giving in the text a composite description based on two species before him, one with reduced venation (an *Elachista*), the other with complete venation. He cites as the type *cygnipennella* Hbn., with figures of fore and hind wing venation; these figures repeat the confusion of the text; the fore wing represents a species with a vein absent, the hind wing represents a species with all veins present. He further adds to the confusion by the statement (p. 211)

primitive members of which have all veins present, and may be considered the primitive group of the family. These feed upon dicotyledonous plants. A second group includes the known grass- or sedge-feeding genera, *Elachista, Cosmiotes,* and *Dicranoctetes,* together with *Hemiprosopa,* characterized in the male genitalia by the presence of the basal process of sacculus. This group includes some of the most specialized members of the family. *Stephensia* stands apart from the other two groups, but appears to be more closely related to the grass- and sedge-feeding genera.

Key to Genera Based on General External Structure

1. All veins present in both wings ..... 1. **Coelopoeta** Walsingham
   At least one dorsal vein absent in each wing 2
2. Veins R_4, R_5, M_1, M_2 and $M_3 + Cu_{1a}$ of the fore wing all stalked together ..... 7. **Dicranoctetes** Braun
   Veins $M_3 + Cu_{1a}$ and M_2 (if present) not out of the stalk of R_{4+5} and M_1 .. 3
3. Labial palpi minute ..... 3. **Stephensia** Stainton
   Labial palpi not minute; recurved, porrected or drooping 4
4. Anal Y-vein present in the fore wing (1b furcate) with both arms distinct; head with loose pendant scales ..... 4. **Hemiprosopa** new genus
   Upper arm of anal Y-vein absent (1b simple), head smooth-scaled, at most side-tufts roughened 5
5. M_1 out of R_5 beyond R_4 ..... 6. **Cosmiotes** Clemens
   M_1 from near base or middle of stalk of R_{4+5} 6
6. Third segment of the labial palpi as long as the second; head short ..... 2. **Onceroptila** new genus
   Third segment of the labial palpi much shorter than the second; head not noticeably short ..... 5. **Elachista** Treitschke

Key to Genera Based on Male Genitalia

1. With process from base of sacculus of harpe 2
   Without such process 5
2. Gnathos one or two spined knobs 3
   Gnathos merely a narrow band ..... 4. **Hemiprosopa** new genus
3. Uncus with widely separated claw-like lobes with acute apices ..... 6. **Cosmiotes** Clemens
   Uncus lobes not claw-like 4
4. Basal process of sacculus elongate and so closely appressed as to appear fused with it; anellus lobes with tufted hairs .. 7. **Dicranoctetes** Braun
   Basal process of sacculus never so closely appressed as to appear fused; setae of anellus lobes inserted singly ..... 5. **Elachista** Treitschke

5. Gnathos with spined knob 6
Gnathos without spined knob ..... 1. **Coelopoeta** Walsingham
6. Uncus absent; aedeagus with conspicuous manica .. 2. **Onceroptila** new genus
Uncus divided into two widely separated conical lobes; no manica
3. **Stephensia** Stainton

Key to Genera Based on Female Genitalia

(**Hemiprosopa** omitted)

1. Posterior margin of seventh abdominal segment forming anterior and lateral margins of ostium; signum with two large opposite spines
6. **Cosmiotes** Clemens
Ostium not fused with seventh segment; signa, if present, otherwise 2
2. Ostium margined latero-posteriorly with two low papillae clothed with long hairs; abdominal tergites "spined" (fig. 2) .. 1. **Coelopoeta** Walsingham
No such papillae; abdominal tergites not spined 3
3. Bursa copulatrix divided by a narrow constriction into a small smooth anterior lobe and a larger posterior spiculate lobe; anterior apophyses furcate ..... 3. **Stephensia** Stainton
Bursa copulatrix not conspicuously bilobed; anterior apophyses not furcate . 4
4. Entire membranous portion of ductus bursae closely spirally coiled (6 or 7 coils); ostium wide ..... 2. **Onceroptila** new genus
Ductus bursae usually not coiled, never coiled except in part of its length; ostium various ..... 5. **Elachista** Treitschke
7. **Dicranoctetes** Braun

1. **COELOPOETA** Walsingham

Coelopoeta Walsingham, 1907. Proc. U. S. Nat. Mus., XXXIII, p. 217.

GENOTYPE: *Coelopoeta glutinosi* Walsingham, 1907.

Head short, smooth-scaled; labial palpi moderately long, smooth, slightly curved, third segment much shorter than the second, acute; tongue well developed, scaled at base. Antennae two-thirds as long as the fore wing, pecten a series of fine hair-like scales attached along nearly the entire length of the scape.

Fore wing elongate, margins convex converging to the subacute apex; all veins present; R_4 from near base of stalk of R_5 and M_1, M_2 closely approximate or connate with their stalk; cross-vein weak between M_2 and M_3: medial stem scarcely discernible; Cu_2 strong distally; 1A + 2A long forked at base (1b long furcate).

Hind wing one-half the width of the fore wing; cilia nearly three times the breadth of the wing; all veins present; Sc + R_1 to beyond middle of wing; R_s and M_1 long stalked; medial stem distinct to base, weak within the cell, forking into the strong tubular M_2 and M_3; Cu_{1a} and Cu_{1b} strong; no cross-veins, cell open between M_2 and $R_s + M_1$ and between M_3 and Cu_{1a}; Cu_2 and two anal veins distinct.

Posterior tibiae with very long hairs above, shorter hairs below; first pair of spurs somewhat above the middle.

Abdominal tergites "spined," *i.e.* with patches of flattened appressed specialized setae (fig. 2).

Male genitalia (figs. 55, 55a, 55b): uncus elongate, strongly sclerotized; socii absent; lateral arms of gnathos uniting to form the upturned concave tip, strongly sclerotized; harpes broad, nearly meeting on mid-ventral line, sacculus broadly lobed apically, lobe setose; ventral plate of anellus shield-shaped, anellus wholly membranous dorsally; vinculum abruptly and broadly produced; aedeagus sinuate, produced at base, no cornutus.

Female genitalia (fig. 101): genital plate largely membranous, a pair of low papillae clothed with long hairs posterior to the ostium, which opens near the center of the genital plate; ductus bursae sclerotized, wide, with an abrupt narrow constriction before flaring to the wide ostium; bursa copulatrix gourd-shaped, signum a dentate patch.

Coelopoeta is the only American genus in which M_2 of the hind wing is present; its origin together with M_3 from the weakened medial stem and the approximation to the radial stem suggest a relationship to those exotic genera in which M_2 is present but has lost its connection with the medial stem and arises from the stalk of $R_s + M_1$, and M_3 is absent. In the other American genera of the family, in the course of evolution M_2 is lost first and M_3 becomes associated with the cubital stem.

The "spined" abdomen, and the different genitalia further indicate that *Coelopoeta* bears no near relationship to the other North American genera. Its general aspect is however distinctly Elachistid; the mouth parts, antennal pecten, and general configuration of the venation at once indicate its family position.

Coelopoeta baldella Busck is sunk as a synonym of *C. glutinosi* Walsingham. The supposed color differences relied on by Busck to separate the two species are individual and seasonal variations. The food plant is the same. Genitalia show no such qualitative differences as have been found throughout the family to separate species.

(1) **Coelopoeta glutinosi** Walsingham (Figs. 1, 2, 55, 55a, 55b, 101.)

1907. *Coelopoeta glutinosi* Walsingham, Proc. U. S. Nat. Mus., XXXIII, p. 218. Types, ♂, ♀, California [British Museum].

1920. *Coelopoeta baldella* Barnes & Busck, Contrib. Nat. Hist. Lepid., IV, p. 248. Type, San Bernardino County, California [U. S. N. M.]. (New synonymy.)

Head white, or in the darker specimens whitish ocherous with a slightly darker speckling; palpi whitish, sometimes a few darker specks outwardly. Antennae whitish, barred above with dark fuscous or black. Fore wings varying from pure white to faintly ocherous, dusted with darker scales, varying in color from pale ocherous little contrasting with the ground color to dark fuscous. In the palest specimens these dark scales are confined to the outer half of the wing, in darker specimens they are more evenly distributed, but tend to form an ill-defined darker patch toward the end of the fold; even in the darkest specimens, a more or less triangular tornal spot remains immaculate. Except for the dark patch on the fold, the darkest scales occur in the apical fourth of the wing along the bases of the cilia and toward tornus. Cilia whitish, sprinkled with darker scales. Hind wings (irrespective of sex) varying from almost white to a dark fuscous gray. Underside of both pairs of wings dark fuscous, darkest in the darker specimens. Legs whitish, with fuscous shading on the fore and middle pair, and dark-tipped tarsal segments. Abdomen whitish, the "spined" patches appearing as transverse shining naked bars.

Alar expanse: 10 to 14 mm.

Male genitalia (figs. 55, 55a, 55b): suture between uncus and tegumen well-defined; both uncus and gnathos strongly sclerotized; cucullus of harpe with a low rounded setose elevation near apex, sacculus terminating in a rounded lobe bearing a few setae.

Female genitalia (fig. 101): the pair of papillae posterior to the ostium bearing very long setae, and the posterior margin of the eighth segment lateral to them with a broad band of similar long setae; within the ostium, a fan-shaped sclerotized patch whose outer convex margin marks the upper margin of the ostium; the narrower posterior part of the bursa copulatrix with longitudinal lines of minute blunt teeth; signum in the anterior part, a small rounded dentate patch; two depressed sclerotized pockets near the latero-ventral posterior margin of the seventh segment.

A large number of specimens (about 150) from various California localities, with June and July dates, have been examined, including the following:

Paratypes (♂, ♀) in the United States National Museum from Walsingham's type series from Mendocino, Lake, Colusa, Shasta, and Siskiyou counties; some of these were reared from galls on leaves of *Eriodictyon glutinosum* (probably *E. californicum*); the dates of the type series extend from June 14 to September 1 (Walsingham, Proc. U. S. N. M., XXXIII, pp. 218 to 219); the type series of *C. baldella* Busck from Camp Baldy, San Bernardino County, in June and July; a series of specimens under *C. baldella* from the San Fernando Valley (Grinnell); a series reared on *Eriodictyon trichocalyx* Heller, labeled

Los Angeles Co., Calif., with dates of emergence, 16–VI–38 to 20–VI–38, "Gall maker in *Eriodictyon trichocalyx*," C. Dammers, Coll.; all of the above in the United States National Musuem. A series [A. F. B. Coll.] from the type locality of *C. baldella* reared from leaves of *Eriodictyon californicum* (H. & A.) Torr. under rearing record B.812, with dates of emergence from June 24 to July 24.

The gall-like mine extends on each side of the midrib on the upper side of the leaf, usually occupying the width of the leaf; the epidermis is so wrinkled that the leaf is curled at the sides and end, and the mine becomes almost hemispherical and gall-like in appearance. Within the mine or gall, the frass is pushed to the roof and separated from the roomy lower part by a thin sheet of silk. In this lower part, the thin cocoon is spun, an elongate-ovate affair, with its anterior end prolonged into a tube which opens outwardly through a semicircular slit in the epidermis.

Most of the paratypes of *C. glutinosi* in the United States National Museum are darker than any of the type series of *C. baldella;* one however is as pale as any of the *C. baldella.* Of my reared series, those specimens emerging later in the season are darker. In most of the series on *Eriodictyon trichocalyx* from Los Angeles County, the hind wings are very dark in both sexes; only occasional specimens of the Camp Baldy series are as dark. Genitalia of these dark specimens are no different from those of the type series of *baldella.* The identical larval habits, with food plants closely related species of the same genus make it probable that we are dealing with one variable species.

2. **ONCEROPTILA** new genus

Head short, smooth-scaled, tongue well-developed, scaled at base, palpi moderately long, porrected or drooping, third segment as long as the second, acute; antennae a little more than half the wing length, basal segment with a pecten of ten or twelve long hair-like scales.

Fore wing (fig. 9) broad lanceolate; R_{4+5} long stalked, M_1 from basal third of stalk; medial stem faintly visible through the cell; M_3 and Cu_{1a} coincident; 1A + 2A without any indication of basal forking (1b simple).

Hind wing (fig. 9) two-thirds the breadth of the fore wing in the basal half, in the female abruptly tapering to the pointed apex with outer half of costa slightly concave, in the male evenly tapering to the less pointed apex with outer half of costa convex; radial sector sometimes with a short fork to costa, more often with not more than an indication of forking; R_s and M_1 long stalked; the

medial stem close to radius, and cell closed; M_2 absent; Cu_2 and two anal veins distinct.

Posterior tibiae with hairs above and below; first pair of spurs at about the middle.

Male genitalia (figs. 53, 53a, 54, 54a): uncus absent, socii reduced or absent; gnathos a spined knob; harpe broad, cucullus narrower, with heavy spine-like setae, costal area weakly sclerotized, sacculus more or less densely setose, the arrangement of the setae suggesting fusion of the basal sacculus process of other genera; anellus completely divided ventrally, the divisions subtended by a small anteroventral plate; vinculum a narrow band; aedeagus with well-developed manica, no cornutus.

Female genitalia (fig. 100): ostium very broad, abruptly narrowing to a sclerotized section of the ductus bursae; ductus bursae spirally coiled, bursa copulatrix indistinctly bilobed; signum present.

GENOTYPE: *Aphelosetia cygnodiella* Busck.

Onceroptila is very closely related to *Perittia* Stainton of the European fauna, agreeing with it in many of the characters of the male genitalia. The conspicuously developed manica, with winged base, is a distinctive character of *Onceroptila,* as well as of the related *Mendesia.* In the fore wing, R_4 and R_5 are long stalked in *Onceroptila,* coincident in *Perittia;* 1A + 2A without any indication of basal forking (1b simple) in *Onceroptila,* furcate in *Perittia.* The hind wings in the two genera are essentially similar except that M_3 in *Perittia* tends to be associated with the medio-radial stem.

Two species are recognized, both of arid regions of the West. Nothing is known of the early stages, but the larvae are doubtless miners of dicotyledonous plants, not of grasses or sedges.

(1) **Onceroptila cygnodiella** (Busck) (Figs. 9, 54, 54a, 100.)

1921. *Aphelosetia cygnodiella* Busck, Canad. Ent., LIII, p. 280. Type, ♂, Victoria, British Columbia [C. N. Coll.].

Head and face brownish fuscous, palpi with a few whitish scales, antennae dark fuscous. Thorax dark fuscous. Basal fourth of fore wing dark fuscous, outer three-fourths of the wing mostly whitish, the scales more or less fuscous-tipped. On the fold at basal fourth a few dark brown scales, followed by a whitish patch; on the middle of the fold an elongate blackish brown spot, followed by a large patch of white scales extending to the dorsum; beyond these white scales the whitish scales of the ground color are more broadly dark-tipped, forming an ill-defined patch which reaches half-way to costa and more or less obscures a smaller dark brown spot at the end of the cell; a few white scales at extreme apex, and beyond these a few dark scales projecting into the cilia.

Cilia pale fuscous with a dark fuscous transverse line through the apical cilia fading out along termen. Hind wing pale fuscous, cilia fuscous with yellowish bases. Legs fuscous, without paler bands. Abdomen dark fuscous, anal tuft of the male yellowish.

Alar expanse: 9 to 11 mm.

Male genitalia (figs. 54, 54a) : socii two nearly hemispherical setose papillae; harpe abruptly narrowing to cucullus and articulating with lobes of anellus near their apices; sacculus well developed, its ventral margin distally elevated into a setose lobe; transtilla present; anellus, two elongate flattened prongs, antero-ventral plate crescent-shaped; vinculum broadening midventrally; aedeagus nearly straight, somewhat produced at base and surrounded in its basal half by the strongly sclerotized manica which apically projects as a hook, and ventrally divides at base into two rectangular wings.

Female genitalia (fig. 100) : ostium very wide, shallow saucer-shaped, abruptly narrowing to a short sclerotized section of the ductus bursae; ductus bursae expanding after inception of ductus seminalis, and spirally coiled; bursa copulatrix densely spiculate, signum large, two opposite dentate arms, one broad, the other shorter and narrower.

Specimens examined: 11 ♂, 5 ♀.

British Columbia: Victoria, 2 ♂ cotypes, 1 ♂, 23.IV.1920 (W. Downes), [U. S. N. M.]; 1 ♂, 26.IV.1920 (W. Downes), [A. F. B. Coll.]; 1 ♀, 5.V.23 (E. H. Blackmore), [A. F. B. Coll.]; 2 ♀, 30.IV.1923 and 5.V.1923 (W. R. Carter), [U. S. N. M.].

Washington: Whitman County, Pullman, Wawawai, Union Flat, and Kamiack Butte, 5 ♂, 2 ♀, April 18 to 24, 1929, 1931, 1932 (J. F. G. Clarke), [U. S. N. M. and A. F. B. Coll.].

California: San Luis Obispo, 2 ♂, March (A. H. Vachell), [U. S. N. M.].

All of the eastern Washington and British Columbia specimens are from the arid belt extending "from eastern Washington, down the Columbia River, north again through the 'arid prairies' of western Washington (Vancouver north to Tacoma and on the Olympic Peninsula at near sea level) to the southern end of Vancouver Island" (J. F. G. Clarke). The two California specimens, as shown by male genitalia, are specifically identical with the more northern specimens.

Food plant and early stages unknown.

(2) **Onceroptila eremonoma** new species (Figs. 53, 53a.)

Head and palpi whitish, with a faint ashy tinge, basal segments of antennae whitish, shading to dark fuscous outwardly. Basal two-thirds of the fore wing whitish, except for a gradually widening stripe along costa, and a few minutely pale fuscous-tipped scales; costal stripe and outer third of the wing evenly

dusted with dark brown, the brown and white about equal; on the middle of the fold a group of darker scales forms an irregular spot; this is followed by a patch of clearer white scales which extends to dorsum; in the apical part of the wing, the dark-tipped scales project irregularly into the cilia of the termen; opposite apex, dark scales form a short oblique bar; through the middle of the cilia, the dark tips of projecting scales form a transverse line through the apical cilia fading out along termen. Hind wings pale silvery fuscous, cilia yellowish at their bases. Legs pale silvery fuscous. Abdomen fuscous.

Alar expanse: 9 mm.

Male genitalia (figs. 53, 53a): socii absent; harpe broadly expanded, cucullus a broad lobe, sacculus clothed inwardly with strong curved setae, broadly lobed at apex; transtilla incomplete, with two setose papillae arising lateral to the acuminate apices of the lateral lobes of the anellus, anteroventral plate of anellus trapezoidal; aedeagus curved toward apex, manica with acute projection apically and ventrally dividing at base into two narrow tapering diverging wings.

Type.—♂, Eureka, Utah, August 9, 1911, (Tom Spalding), [U. S. N. M. Type No. 34825].

Paratype.—1 ♂, same data as the type.

Food plant and early stages unknown.

O. eremonoma is separated from *O. cygnodiella* by the pale base of the fore wing, the even dusting of the outer third of the wing and the absence of a discal spot at the end of the cell. In male genitalia it is strikingly different (compare figs. 53 and 54); the female is unknown.

3. **STEPHENSIA** Stainton

Stephensia Stainton, 1858. Trans. Ent. Soc. London, (2) IV, pp. 269–270.

GENOTYPE: *brunnichiella* (Linnaeus).

Head entirely smooth-scaled; labial palpi short, in the American species minute; tongue short, scaled at base. Antennal pecten of one or two fine hairs, stalk sparsely ciliate in female, finely pubescent in male.

Fore wing (figs. 10, 11) lanceolate; R_4 and R_5 long stalked, and R_5 to costa at apex, or, in the American species, R_4 absent; M_1 out of stalk of R_{4+5}; M_3 absent (or coincident with Cu_{1a}); 1A + 2A not forked at base (1b simple).

Hind wing (figs. 10, 11) one-half to two-thirds the width of the fore wing, lanceolate, pointed; Sc + R_1 reaching costa near middle of wing; R_s and M_1 stalked, M_2 absent, M_3 and Cu_{1a} approximate in the type of the genus, coincident in the American species; Cu_2 distinct and two anal veins discernible.

Posterior tibiae with short, stiff, more or less appressed hairs above; first pair of spurs somewhat above the middle.

Male genitalia (figs. 52, 52a): uncus lobes conical, setose at apex; gnathos a more or less elongate spined knob; harpe elongate, cucullus abruptly pointed,

basal process of sacculus fused except at apex; ventral plate of anellus, two conical lobes; aedeagus straight, no cornutus.

Female genitalia (figs. 102, 102a): anterior apophyses furcate; ductus bursae coiled; bursa copulatrix bilobed, signum large, dentate.

Two species of the genus are known, one European, one North American; both are miners in leaves of species of Labiatae.

The egg (of *S. cunilae*) (fig. 24) is a leaning cone, strongly ridged, with the micropylar area vertically placed on the short side of the cone.

The full-grown larva (of *S. cunilae*) is cylindrical with the head but little flattened; the head capsule is broad, rounded, lying horizontal; prothoracic shield transversely elliptical; a pair of small rounded sclerotized plates is present on the ventral surface of the first thoracic segment; the three pair of thoracic legs are well developed and functional; abdominal prolegs are present on segments 3, 4, 5, 6 and 10; the crochets except on the anal prolegs form a complete circle, weakest toward the meson and anterior; the crochets of the anal prolegs form an anterior half circle; a small though well-sclerotized suranal plate is present; setae moderate in length.

There is no such extreme development of tubercles and spines in the pupa of *S. cunilae* (fig. 33) as in the pupae of species of the grass-feeding genera; the thorax bears merely low rounded humps and is without the sculpturing characteristic of *Elachista;* the appendages are fused to the body to the posterior margin of segment 7.

Meyrick (1927, Revised Handbook of British Lepidoptera, p. 711) interprets the three stalked veins from apex of cell of fore wing in *S. brunnichiella* as veins 5, 6 and 7 (M_2, M_1, and R_5), with 8 (R_4) absent. I prefer to homologize these veins with the similarly placed veins in other genera of the family, *i.e.* as 6, 7 and 8 (M_1, R_5, R_4) with vein 7 (R_5) reaching costa at apex. Vein 4 (M_3) is then the vein absent or coincident with vein 3 (Cu_{1a}). In the American species, vein 8 (R_4) is absent, the stalk dividing into two veins only, the upper by its form apparently R_5 alone.

The interpretation of the structures of the male genitalia here referred to as lobes of the uncus is open to some question; by some authors they may be regarded as the socii; however a few setae near the arms of the gnathos, elsewhere homologized with the socii, are present in *Stephensia.*

(1) **Stephensia cunilae** Braun (Figs. 11, 24, 33, 52, 52a, 102, 102a.)

1930. *Stephensia cunilae* Braun, Trans. Amer. Ent. Soc., LVI, p. 9. Type ♂, Adams County, Ohio [A. F. B. Coll.].

Head dark golden bronzy, palpi minute, basal third of antennae blackish bronzy, each segment of outer two-thirds marked above with a silvery spot. Thorax and extreme base of fore wing dark reddish bronzy; rest of wing dark brown with a faint bronzy luster; markings pale golden. A broad subbasal fascia, a second narrower fascia before middle, a perpendicular spot at tornus reaching half way across the wing, a curved costal spot farther out connected with an arrowhead-shaped mark in the apex of the wing; cilia dark brown. Hind wings and cilia dark grayish brown. Basal segments of the legs with silvery and bronzy reflections; tibiae and tarsi blackish brown; hind tibiae with median and apical white bars. Upper side of abdomen dark bronzy, under side pale golden.

Alar expanse: 6.5 to 7 mm.

Male genitalia (figs. 52, 52a): uncus lobes with a few apical setae; gnathos ellipsoidal; harpe narrow, tapering, cucullus with erect setae, abruptly pointed, sacculus narrow, fused sacculus process indicated by an apical lobe; ventral plate of anellus with two rounded conical lobes; lateral to each anellus lobe, a thin membranous bulbous sac; vinculum with a small anterior point; aedeagus straight, truncate at base, at apex dorsally acutely produced.

Female genitalia (figs. 102, 102a): seventh abdominal sternite with two internal narrow transverse sclerotized plates; ostium located at anterior margin of the genital plate, here only well sclerotized, round, narrowing to the long, coiled ductus bursae; bursa copulatrix bilobed, sharply constricted between the lobes, the larger posterior lobe spiculate and bearing the broadly dagger-shaped dentate signum, the anterior small lobe smooth, lying in the first abdominal segment.

Specimens examined: 6 ♂, 2 ♀.

OHIO: Adams County, Beaver Pond, ♂ type, under rearing record B.1353, imago September 6, 1928; Beaver Pond and Mineral Springs, under rearing record B.1353, 2 ♂, 2 ♀ paratypes, imagoes July 11 to 18, 1928, 1 ♂ paratype, September 10, 1928; 1 ♂, imago, July 15, 1931 [A. F. B. Coll., and 1 ♂ paratype in B. M., Meyrick Collection].

KENTUCKY: Fleming County, Blue Bank, 1 ♂, under rearing record B.1353, imago June 20, 1945 [A. F. B. Coll.].

INDIANA: Bartholomew County, larva and pupa only, June 30, 1945 [A. F. B. Coll.].

The larva mines leaves of *Cunila origanoides* (L.) Britton (Labiatae). There are two generations a year; mining larvae may be found in June and in August, producing moths in late June, July and September; the second generation apparently hibernating in the adult state.

The strongly ribbed, semi-erect egg (fig. 24), dark gray in color, is deposited on the under side of the leaf near the midrib. The mine, at first narrow, extends toward the tip of the leaf, expanding into a blotch and occupying the outer half of a larger leaf; the leaf parenchyma is entirely consumed and frass retained within the mine; a series of fine folds in the lower epidermis, spreading out funnel-shaped from the earlier part of the mine, crumples the leaf during the later feeding stages of the cylindrical larva. The entire mine is characteristically grayish. The larva is whitish, with a very slight tinge of green; head black, prothoracic shield black, divided by a longitudinal white line. The larva leaves the mine by a slit in the lower epidermis, and pupates in a fold of a leaf beneath a fine, closely woven sheet of silk. The pupa is illustrated by figure 33.

Although the food plant is common in oak woods of the Allegheny and Cumberland plateaus, *S. cunilae* appears to be rare and local. It is difficult to rear because of the resinous character of the leaves.

4. **HEMIPROSOPA** new genus

Eurynome Chambers, 1877. Bull. U. S. Geol. Surv., III, p. 140; 1879, Journ. Cin. Soc. Nat. Hist., II, p. 196 and fig. 45.

Not *Eurynome* Chambers, Cin. Quart. Journ. Sci., II, 304, 1875; not *Busckia* Dyar, Bull. 52, U. S. N. M., p. 563, 1903.

GENOTYPE: *Eurynome albella* Chambers, 1877.

Head (fig. 4) clothed with long loose forwardly directed and pendant scales, which hang down between the antennae partially concealing the eyes, but leaving the lower part of the smoothly scaled face exposed. Tongue short, scaled at base. Labial palpi short, drooping, second segment loosely scaled and appearing as if enlarged at apex; third segment shorter than the second, abruptly acute. Antennae a little more than half the length of the fore wings, basal segment loosely scaled, bearing on its basal half a pecten of long slender scales.

Fore wing (fig. 5) lanceolate, acute; R_3 from base of stalk of R_{4+5} and M_1; R_4 and R_5 coincident; medial stem faintly visible through the cell, M_3 and Cu_{1a} coincident; 1A + 2A forked at base (1b furcate).

Hind wing (fig. 5) two-thirds the breadth of the fore wing, lanceolate, acute, evenly tapering, costa arched; $Sc + R_1$ to middle of costa, R_s and M_1 separating well before apex, M_2 absent, medial stem approximating the radial stem, and cell imperfectly closed between M_3 and $R_s + M_1$; Cu_2 weak, anal veins distinguishable.

Posterior tibiae with fine hairs above and below, first pair of spurs somewhat below the middle.

Male genitalia (figs. 58, 58a): uncus absent; a pair of long setae on each side lateral to the anal opening and above the gnathos; gnathos reduced to a narrow band; harpe as in *Elachista,* with free outgrowth from middle and club-shaped sacculus process, setose at apex, cucullus with long decumbent setae; anellus deeply bilobed, arms diverging, setose at apex and outer margin to the point of articulation with the free outgrowth of harpe; vinculum greatly produced and gradually tapering to the rounded point; aedeagus long, slender, tapering, produced at base into an elongate blind sac; no cornutus.

Female genitalia not examined.

Under the generic name *Eurynome* Chambers (not Leach), Chambers described two species; the first of these, *luteella,* in 1875, in the Cincinnati Quarterly Journal of Science, II, p. 304; later (1877) in the Bulletin of the United States Geological Survey, III, p. 140, he added the second species, *albella,* whose wing venation was examined. For the preoccupied *Eurynome,* Dyar proposed the new name *Busckia.* The two species are not congeneric; *Busckia* must be restricted to the first described species, *luteella.* The new genus, *Hemiprosopa,* is erected for the second species, *albella,* which is Elachistid. *Busckia luteella* probably is properly placed in the Lyonetiidae, with the genus *Busckia* a synonym of *Philonome.* Unfortunately, the head of the type of *luteella* was missing when both *luteella* and *albella* were examined by the writer in 1922,[5] but Chambers' comparison with *Philonome clemensella* suggests a large erect tuft on the vertex as in *Philonome.*

Hemiprosopa is somewhat aberrant in the family in the absence of the spined knob of gnathos. The loose scales of the head, which might be described as forming an appressed tuft, are also unusual in the family. The harpe with sacculus process, and anellus of the male genitalia, the venation, and the scaled tongue place it in the Elachistidae. The characters of the male genitalia indicate affinity with the grass-feeding genera rather than with the group of genera typified by *Perittia* and *Mendesia.*

(1) **Hemiprosopa albella** (Chambers) (Figs. 4, 5, 58, 58a.)

1877. *Eurynome albella* Chambers, Bull. U. S. Geol. Surv., III, p. 140. Type ♀, Edgerton, Colorado, altitude about 6500 feet. [Represented now only by a slide of denuded wings in the U. S. N. M.].

[5] At that time I noted that the head and one fore wing of the type of *luteella* were missing but that the species appeared to be Lyonetiid. Mr. Nabokov has informed me (1947) that the type of *albella* is not now in the Museum of Comparative Zoology. A slide of denuded wings in the United States National Museum labeled "type" is all that remains of the type of *albella.*

1903. *Busckia albella* Dyar, Bull. 52, U. S. N. M., p. 563.

1939. *Philonome albella* McDunnough, Check List of Lepidoptera, Part II, p. 100.

Loose hairs of the head pure white; palpi white; scape and first few segments of antennal stalk white, outer part of stalk pale fuscous. Thorax and fore wings white; a few pale ocherous scales form a faint spot at the middle of the fold, a second similar spot at the end of the fold, and a smaller spot at the end of the cell; the apex of the wing is faintly tinged with ocherous. The ocherous spots may be nearly obsolete. Minutely fuscous-tipped scales project into the cilia before and below apex, and beyond these, the minute fuscous tips of scales form a more even fine line through the white cilia. Hind wings white, shining; cilia faintly ocherous at their bases. Legs white.

Alar expanse: 9.5 to 10.5 mm.

Male genitalia (figs. 58, 58a): slide from specimen from Association Camp, Colorado (Slide #3, 15 Jan. 1941, C. H.), [U. S. N. M.].

Female genitalia not examined.

Specimens examined: 3 ♂, ♀ type.

COLORADO: Edgerton, ♀ type,[6] altitude 6500 feet; Association Camp, 1 ♂, June 1936, (Cockerell), [U. S. N. M.].

SASKATCHEWAN: Saskatoon, 2 ♂, June 8, 1939, "16446G, 1223AN" (Kenneth M. King), [Canadian National Collection, received for study from the U. S. N. M.]; 1 ♂, June 20, 1939, "16446G, 1225AN," slides of wings and male genitalia only (received from the U. S. N. M. for study).

In the United States National Museum there is a slide of denuded wings labeled "*Busckia* [Dyar] [*Eurynome*] *albella* Cham., Type. AB ok," presumably made from the type. The venation of these wings agrees with figure 5, from one of the Saskatchewan specimens, except that R_3 arises a little farther from the base of the stalk.

Food plant and early stages unknown.

5. **ELACHISTA** Treitschke

Elachista Treitschke, 1833. Schmett, Eur., II, 177; genotype, *bifasciella* Tr.

Aphelosetia Stephens, 1834. Ill. Brit. Entom., Haust. IV, 287–288; genotype, *argentella* Clerck.

Poeciloptilia H.S., 1853 (nec. Hbn.).

Phigalia Chambers, 1875. Canad. Ent., VII, 107; (pre-occ.); genotype, *albella* Chambers.

Hecista Wallengren, 1881. Ent. Tidskr., II, 95; genotype, *argentella* Clerck.

Aphigalia Dyar, 1903. Bull. U. S. N. M., no. 52, p. 544; genotype, *Phigalia albella* Chambers.

[6] Type examined December, 1922, [M. C. Z.]; now missing.

Head smooth scaled, slightly roughened posteriorly. Tongue present. Labial palpi long, somewhat recurved, reaching the vertex, or sometimes nearly straight and porrect or divergent; in the specialized species, much shorter, straight and drooping; third segment shorter than the second. Maxillary palpi obsolete. Antennae with scape short; the antennal pecten varies from a conspicuous series of long hair-like scales along half or more the length of the scape in the more primitive species to a series of fewer short hairs and is finally reduced in the most specialized species to as few as one or two slender hairs at the base of the scape, stalk about three-fourths the wing length, or occasionally shorter, often slightly thickened in the male. (Compare figs. 3, 6, 7, 8.)

Fore wing (plates II, III) narrow lanceolate to broad lanceolate, acute; R_1 from near middle of cell, R_3 sometimes from base of R_{4+5}, R_4 and R_5 stalked or coincident, M_1 out of the stalk of R_{4+5}, medial stem usually faintly visible through the cell, M_2 sometimes absent, M_3 and Cu_{1a} united,[7] $1A + 2A$ strong, basal forking sometimes indicated by an obsolescent 1A.

Hind wing (plates II, III) one-half to two-thirds the width of the fore wing, acute to acuminate; $Sc + R_1$ reaching costa near middle of wing, radial sector to costa, with forking faintly indicated in primitive species, M_1 stalked with R_s, the medial stem approximating the radial stem distally, M_2 absent, cell closed between $R_s + M_1$ and M_3 in primitive species, open in others, M_3 when present associated with the cubital stem, or M_3 absent, or both M_3 and Cu_{1a} absent.[8]

Hind tibiae with long hairs above, less hairy to nearly smooth below; position of middle spurs varying from one-fourth to middle of segment.

Male genitalia (plates X to XIX): uncus present, usually bilobed, rarely merely emarginate, setae dense, either short and curved, or long, or in the primitive species very few or absent, suture distinguishable in the primitive species; socii vestigial, reduced to small soft papillae bearing a few minute setae or represented by a group of minute setae; gnathos either single or double, knob-shaped or ellipsoidal, with transverse rows of comb-teeth; harpe broadly attached to vinculum, and also loosely articulated with anellus by a free outgrowth from middle or by a shorter free arm from base near costa; cucullus clothed with long to very long decumbent setae, rarely margin prolonged into a strong

[7] Homology determined from pupal tracheation (Braun 1933, Trans. Amer. Ent. Soc., LIX, pp. 253, 254).

[8] Since the British system of numbering veins 1 to 12 has been used more generally in Microlepidoptera, the following description of venation on that basis is here included:

Fore wing 1b usually simple, upper fork sometimes faintly visible; 3 and 4 coincident, 5 sometimes absent, 6 and 7 stalked, 8 out of 7 or absent, 9 sometimes from base of stalk of 6, 7, and 8, 11 from near middle of cell. Hind wing 4 sometimes absent, rarely 3 and 4 absent, 5 absent, 6 and 7 stalked, transverse vein sometimes partly absent.

spine near apex; sacculus well developed, with process from base, also weakly articulated with anellus; ventral plate of anellus bilobed, the lobes variously formed and more or less setose; aedeagus usually nearly straight, with entrance of penis on dorsal side of swollen base, or (in *madarella* group) elaborately curved and pronged; cornuti, one to several short to long spines, rarely many small spines, cornutus sometimes absent; vinculum usually more or less produced anteriorly.

Female genitalia (plates XIV, XXI to XXVI): bursa copulatrix usually lying in the third and fourth and part of fifth abdominal segments, sometimes extending into the second segment, membrane usually minutely spiculate, signum either present or absent, when present, it consists of one or two (rarely three) dentate patches or bands; ductus bursae usually moderately long, sometimes very long and spirally coiled in part of its length, if sclerotized toward its posterior end, ductus seminalis arising just anterior to sclerotized part; ostium opening in the mid-line, usually at or near the anterior margin, rarely near the center, or even nearer the posterior margin of the eighth segment; genital plate often weakly sclerotized except along the ventral anterior margin of the ostium.

Sclerotized plates may be present in both sexes on the ventral or dorsal, or both surfaces of some of the abdominal segments. In females of several of the most specialized species, a strongly sclerotized plate on the tergum of the seventh segment bears dense tufts of lusterless knobbed hairs.

The genus *Elachista* is represented in all parts of the world, with the greater number of species in temperate North America and Europe. It is most poorly represented in South America, from which region but two or three species have been described. Many of our species have a wide geographic distribution.

All of the species of *Elachista* here treated, in so far as the life histories are known, are miners in leaves of species of Gramineae and Cyperaceae. No North American species is known to mine in leaves of Juncaceae, although such are known in Europe.

The egg[9] is flattened ovoid or ellipsoidal, closely appressed to the leaf surface, iridescent, with parallel or sometimes irregularly branching longitudinal ridges, which may be broken at intervals, thus producing a rugose rather than a longitudinally ridged surface. (Plate III, figs. 25, 26.)

The larva upon hatching passes directly through the epidermis beneath the egg into the leaf tissue. The larvae are tissue feeders, therefore there is no extreme modification of head capsule or mouth-

[9] Description made from egg-shell at beginning of collected mines.

parts (plate III, figs. 22, 22a, 23). The head is flattened dorso-ventrally and lies horizontal, *i.e.* in the same plane as the body. The margin of the head capsule, mouthparts, tentorium (or endoskeletal ridges), which are strongly sclerotized, and the black ocelli, contrast with the otherwise pale head. Ocelli, three dorsal and two ventral; in the more specialized species the dorsal ocelli become crowded together and may be in contact. The body of the larva is flattened, the breadth greater than the thickness dorso-ventrally, but retains the cylindrical tissue-feeding form. The form and degree of sclerotization and hence coloration of the prothoracic shield is fairly constant for the species. Many species have in addition a pair of sclerotized patches on the ventral surface of the first thoracic segment. Three pairs of thoracic legs are present, the first pair often smaller than the others; in the flatter larvae of the *madarella* group, both prothoracic and mesothoracic legs are small or minute and apparently functionless. Prolegs are present on abdominal segments 3, 4, 5, 6, and 10; on all except the anal prolegs, the crochets are arranged in a uniordinal lateral penellipse, with the opening toward the meson and anterior; on the anal prolegs the crochets are arranged in an anterior half circle. A more or less well sclerotized suranal plate is present in many species. The setae are sometimes very short or minute, sometimes very long (e.g. *radiantella*). The seta map (figure 21) is that of a typical member of Section II, in which the setae, though short, are readily discernible. Comparative study of additional species of *Elachista* and related genera is necessary for complete interpretation; this is beyond the scope of the present paper.

The mine is at first thread-like, gradually and irregularly broadening, sometimes becoming a blotch (plate IV). Many species form more than one mine, but are at no time external feeders. Within the mine most of the parenchyma is consumed, with here and there patches of green tissue remaining. Whether the mine is more apparent from upper or lower side of the leaf depends on whether the uneaten tissue is attached to upper or lower epidermis. Larval feeding is initiated in many species in the fall, on the overwintering leaves of the grass or sedge; such species remain dormant during the winter, with feeding completed in the spring. In some species, the larva may form a very short mine in the early part of the season, then lie dormant for several months, resuming mining and reaching maturity in late fall. In other

species development is continuous, with no dormant period. Most of the species appear to be single-brooded; a few are known to be two-brooded. Many of the species are confined to a single species of grass or sedge.

Pupation takes place outside of the mine, and usually immediately after feeding is completed. The pupa is either exposed, attached only by the anal end and a silken girdle which passes over the abdomen, lying in the suture between the fourth and fifth abdominal segments, or is covered with a loose network of silk, the fibers sometimes very regularly arranged (fig. 31). In general, when the pupa is exposed, the cuticle is dull and opaque in appearance; when enclosed in a cocoon, it is shiny. Forms intermediate between these two types occur. These differences are adaptive and of no value in grouping of species.

The head and thorax of the pupa are characterized by rounded tubercles with sculpturing of the vertex and mesothorax, longitudinal—either continuous or broken—ridges of the mesothorax; in a few species longitudinal rows of fine tubercles occur on the wings. The dorsal surface of the abdomen is more or less depressed and usually shows three distinct, often conspicuous, longitudinal ridges, one mid-dorsal and one at each margin, the latter bearing the spiracles. The mid-dorsal may or may not extend onto the thorax. A cremaster is present, of various shapes, usually three-lobed. It may or may not bear setae, but when present, these are usually hooked.

Vertex produced, sometimes projecting hood-like over the front; epicranial suture present; maxillary palpi absent, maxillae concealing the labial palpi; tibiae and tarsi of pro- and mesothoracic legs concealing the femora; tip of tarsi of metathoracic legs visible caudad of antennae, between the tips of the mesothoracic wings; all of the appendages are fused to one another and to the body to or a little beyond the caudal margin of the fifth abdominal segment. No movable incisures. The abdominal spiracles are sometimes produced.

Pupal characters are constant for the species, except for minor variations in size of tubercles and ridges of the mesothorax, and are reliable criteria for species separation. Pupae of all species whose life histories are known are figured on plates V, VI, VII.

Imagoes emerge from two to several weeks after pupation; the period of emergence may extend over a considerable time.

Wing markings show great diversity. Species closely similar in imaginal markings may be separated by pupal characters and by genitalia. In the males, reliable characters for species separation are found in shape and length of harpe, in shape of sacculus process, in anellus, and especially in the presence or absence of and character of cornuti, the last being a determining and constant character. The shape of the vinculum may vary somewhat within the species.

In the females, good characters are the shape of the dilated portion of the ductus bursae before ostium, the length of the sclerotized portion of the ductus before ostium, the presence or absence of teeth at the inception of the ductus seminalis, the presence or absence of teeth along the ductus bursae, and the signum.

On the basis of wing venation and genitalic characters the species fall into three sections:

I. Cell of the hind wing closed (except in some *patriodoxa*). Uncus lobes with few or no setae.

II. Cell of the hind wing open. R_2 of fore wing farther from R_1 than from R_3. Uncus lobes densely setose.

III. Cell of the hind wing open; hind wing broad. R_2 and R_3 of fore wing widely separated, farther apart than R_1 and R_2; Cu_{1b}, $Cu_{1a} + M_3$ and M_2 arising opposite the space between R_2 and R_3. Specializations of genitalia in both sexes.

Section I. Species 1–19

This section includes the primitive species of the genus, characterized in venation by the closed cell of the hind wing, with M_3 more or less approximate to the radial stem (in *patriodoxa* only, the crossvein closing the cell of the hind wing is usually absent, but the vein configuration is typical of the section, with M_3 arching up toward the radial stem); R_4 and R_5 of the fore wing may be stalked or coincident (figs. 13, 14, 15). The hind wings vary in breadth; they may be evenly tapering or acuminate at apex. The antennal pecten is well developed, with as many as 10 or 12 long hair-like scales; the labial palpi are usually long and distinctly recurved (fig. 6).

In the male genitalia, the uncus lobes have few or no setae, they are usually close together and often not cleft to the suture, which is distin-

guishable in this section; the free outgrowth of harpe is well developed and from middle of inner surface.

There is greater diversity of structure of the female genitalia than in the other two sections; the ductus bursae is often very long and may be coiled, with bursa copulatrix lying as far anterior as the second abdominal segment.

The immaculate or nearly immaculate white species are so similar that they can be separated only by genitalic characters.[10]

The life history of but two of the species here included is known.

Section II. Species 20–45

The cell of the hind wing is open; in the fore wing R_2 is much farther from R_1 than from R_3. The typical venation of the section is illustrated by figure 17.

In the male genitalia, the tegumen is usually short, uncus lobes densely setose. In the female, the bursa copulatrix lies in the third, fourth, and part of the fifth abdominal segments, and the ductus bursae is comparatively short; a signum is usually present.

Within this section, a small group of specialized species (*radiantella, solitaria, praelineata*) is characterized by the further reduced wing venation, by the dense mass of elongate lusterless knobbed hairs attached to the seventh abdominal tergite in the female, and by both male and female genitalic characters. In the male, the harpes are narrow, with reduction of cucullus, and the sacculus processes are reduced to narrow rods or minute spoon-like structures without setae; cornuti many small spines. In the female, the genital plate is not differentiated, the ventral margin only of ostium sclerotized, and the ductus bursae membranous throughout; no signum.

On the whole, the species of this section form a homogeneous group structurally. Exceptional in the section, but nevertheless properly belonging here are *agilis, cucullata, leucosticta; salinaris* and *tanyopis,* with the strong apical spine of harpe; and the three specialized and reduced species.

The type of the genus, *bifasciella* Trietschke belongs in this section.

[10] In the descriptions of wings and antennae, differentiation of the species is attempted. Where specimens have been relaxed for mounting, these structures may be stained and hence of no value in discriminating species.

Section III. Species 46–48

The three species included in this section are characterized by the greater breadth of the hind wing, and by differences in position of certain of the veins of the fore wing as compared to the two preceding sections. Cu_{1b}, $Cu_{1a} + M_3$, and M_2 arise opposite the space between R_2 and R_3; and R_2 and R_3 are widely separated (fig. 18).

The short stiff setae of the uncus lobes, the shape of the anellus lobes, the lobed and pronged aedeagus, the reduction of the free outgrowth of harpe to an acute projection from base near costa in the male; the specialized genital plate, and row of strong setae fringing the dorsal posterior margin of the eighth segment of the female are characteristics of the section.

* * * * *

I have included 48 species in *Elachista,* of which 16 are described as new. Of the 41 species listed under the genus in McDunnough's 1939 Checklist, 11 have been removed from *Elachista.* Of these eleven, *bicristatella* Chambers, *concolorella* Chambers, *orichalcella* Clemens, *metallifera* Walsingham are Cosmopterygids; no type[11] of *inornatella* Chambers is in existence, but it is probably also a Cosmopterygid. Two of the types of *texanella* Chambers at the Museum of Comparative Zoology, one bearing the name in Chambers handwriting, are Scythrids; the third is probably a Cosmopterygid. The remaining five species of the eleven belong in other genera of the Elachistidae. *Illectella* is the type of *Cosmiotes* Clemens, restricted, with *praematurella* a synonym, and *herbigrada* Braun is transferred to *Cosmiotes; brachyelytrifoliella* Clemens, of which *angularis* Braun is a synonym, is placed in *Dicranoctetes* Braun; *cygnodiella* Busck is made the type of a new genus.

Philopatris Meyrick is a synonym of *irrorata* Braun. *Maritimella* McDunnough was added since the publication of the checklist.

Aphigalia Dyar (*Phigalia* Chambers) is sunk as a synonym of *Elachista* and the first species described under it, *albella* Chambers, transferred to *Elachista. Phigalia ochremaculella* Chambers, described immediately after *albella,* is doubtfully Elachistid and is included as an

[11] The *inornatella* type at the Museum of Comparative Zoology is *Eulyonetia inornatella* Chambers, but is placed under *Elachista.*

unrecognized species. No type is in existence. *Laverna albella* Chambers is transferred to *Elachista* from the Cosmopterygidae, and the new name, *adempta,* proposed for the preoccupied *albella.* *Texanica* Frey and Boll is doubtfully included in *Elachista.*

Key to the Species of Elachista Based on Venation and Coloration[12]

I. Cell of hind wing closed (except some *patriodoxa*), M_3 arching up toward the radial stem ..... Section I, species 1–19

1. Fore wing black or blackish, with transverse white marks 2
   Fore wing white or whitish 3
2. A median white fascia only ..... (18) **hiberna**
   A median white fascia and costal and dorsal spots beyond (19) **patriodoxa**
3. Fore wing immaculate pure white 4
   Fore wing with at least a few dark scales 8
4. Eastern species 5
   Western species 6
5. Antennae dark gray, scape only white ..... (10) **griseicornis**
   Antennae white, grayish only toward tips ..... (11) **acenteta**
6. Hind wing very acuminate, R_s and M_1 very long stalked.. (15) **sincera**
   Hind wing less strongly acuminate 7
7. Ovipositor large, lobes blade-like, conspicuous ..... (14) **lamina**
   Ovipositor normal ..... (12) **hololeuca** (13) **purissima** some (6) **aurocristata** some female (9) **adempta**
8. A few widely scattered dark scales on the fore wing, no other marks .. 9
   Fore wing with more or less distinct plical and discal brown or black spots, sometimes obsolete, or with more or less brownish fuscous dusting 11
9. Veins R_4 and R_5 of fore wing separate ..... (7) **controversa**
   Veins R_4 and R_5 of fore wing united 10
10. Palpi longer, third segment slender, evenly tapering to acute apex (8) **albella**
    Palpi shorter, third segment abruptly acute ..... (9) **adempta**
11. Fore wing densely dusted with brownish fuscous 12
    Fore wing white, with sparse or no dusting; a plical and a discal brown or black spot, sometimes obsolete 13
12. Dusting absent in a broad stripe from base along fold and outer margin of cell ..... (17) **coniophora**

[12] Not included in the key: *ochremaculella* Chambers.

Entire wing evenly dusted; faint plical and discal spots (16) **parvipulvella**

13. With a few dark scales projecting into the cilia at tornus 14
Without such scales 15
14. Hind wings white in both sexes; eastern ..... (3) **orestella**
Hind wings pale straw-colored; western .....(2) **symmorpha**
15. Plical and discal spots distinct, or sometimes of only 2 or 3 dark scales 16
Plical and discal spots minute, pale, or sometimes obsolete 17
16. Plical spot at two-thirds the length of the fold; western .. (4) **synopla**
Plical spot at four-fifths the length of the fold; eastern .. (1) **epimicta**
17. Microscopically ocherous-tipped scales in the costo-apical half of the wing; brownish-tipped scales projecting into cilia at apex and along termen ..... (5) **spatiosa**
Scattered brownish ocherous scales; a fine blackish line through the cilia ..... (6) **aurocristata**

II. Cell of hind wing open, M_3 not arching up toward the radial stem; R_2 farther from R_1 than from R_3 (see also III)

Section II, species 20–45

1. M_3 of hind wing present 2
M_3 of hind wing absent 27
2. Ground color of the fore wing blackish or dark brown, or irrorated gray 3
Ground color of the fore wing white or pale ocherous, more or less overlaid with fuscous or ocherous dusting 22
3. An orange spot at base of dorsum ..... (35) **texanica**
No orange spot at base of dorsum 4
4. A white or silvery patch at or almost at base of fore wing 5
No white or silvery mark at base of fore wing 11
5. A complete white or silvery median fascia 6
Fascia incomplete, broken, or reduced 10
6. Basal white patch confined to dorsum ..... (27) **stramineola**
Basal white or silvery patch extending from costa to dorsum 7
7. Silvery costal spot beyond fascia curving toward apex in the middle of the wing 8
Silvery or white costal spot beyond fascia not produced toward apex .. 9
8. Apical fifth of antenna white ..... (30) **sylvestris**
Antennae dark gray throughout ..... (31) **nitidiuscula**
9. Head silvery white ..... (29) **albicapitella**
Head dark gray, face only creamy white ..... (28) **leucofrons**
10. Fascia silvery white, ending before reaching dorsal margin (32) **cucullata**
Fascia reduced to scattered whitish scales some male (27) **stramineola**

11. A median pale fascia 12
    No median pale fascia 19
12. Median fascia silvery, followed by a costal silvery spot only (25) **maculoscella**
    Median fascia followed by a costal and a nearly opposite tornal pale spot 13
13. Costal and tornal spots uniting to form a second similar fascia (23) **pusilla**
    Costal and tornal spots, if meeting, forming an angulated fascia ... 14
14. Thorax wholly dark 15
    Tips of tegulae and mesothorax white or whitish, or if not contrasting then entire thorax pale gray 17
15. Fore wing much darker behind the fascia than before it (24) **unifasciella**
    Fore wing not darker behind the fascia than before it 16
16. Fascia and spots shining white; veins M_2 and $M_3 + Cu_{1a}$ separate (21) **fuliginea**
    Fascia and spots white, not lustrous, often reduced in male; M_2 and $M_3 + Cu_{1a}$ connate or short stalked ..... (20) **irrorata**
17. Scales of fore wing creamy-white at base, general color pale gray, palest in apical area; fascia obscure ..... (26) **excelsicola**
    Scales of fore wing, if pale at base, broadly tipped with dark brown or gray; general color dark gray or brown, irrorated, not paler in apical area 18
18. A broad, well-defined creamy white fascia .... female (22) **oxytypa**
    Fascia very narrow, ill defined, and sometimes nearly obsolete male (27) **stramineola**
19. Fore wing with a white apical spot ..... (34) **leucosticta**
    No white apical spot 20
20. An elongate white spot in fold near base, followed by the black plical spot ..... (40) **inaudita**
    No such spot 21
21. Marks golden or silvery; a bar from basal fourth of dorsum to fold (33) **agilis**
    Marks grayish white; a bar from near middle of dorsum to fold or beyond ..... male (22) **oxytypa**
22. Plical spot present, black or very dark brown 23
    Plical spot absent 24
23. Basal two-thirds of fore wing pure white, undusted; western (42) **salinaris**
    Fore wing more or less dusted, the dusting defining the white costal and tornal spots; eastern ..... (41) **tanyopis**
24. Fore wing pale ocherous, with ill-defined paler fascia and costal and tornal spots 25

Fore wing white, with dark-tipped scales forming longitudinal lines . 26

25. Dusting usually sparse, but when present, evenly distributed; northeastern ..... (36) **maritimella**
Dusting denser, but absent in the dorsal half of the wing before the fascia; western ..... (37) **staintonella**

26. Fore wing white, the scales forming the longitudinal lines the only dark scales ..... (38) **cana**
Scales of the fore wing white with pale gray tips; longitudinal lines of darker gray scales ..... (39) **amideta**

27. Marks metallic silvery or golden 28
Marks white ..... (43) **praelineata**

28. A small silvery gray spot at base of costa ..... (44) **solitaria**
An oblique silvery fascia almost at base ..... (45) **radiantella**

III. Cell of hind wing open; R_2 and R_3 widely separated; Cu_{1b}, $Cu_{1a} + M_3$, and M_2 arising opposite the space between R_2 and R_3. Wing markings metallic golden or silvery ..... Section III, species 46–48

1. Apical fifth of antenna yellowish white ..... (46) **madarella**
Antennae dark brown or black throughout 2

2. A silvery or golden spot in the middle of the wing near apex (47) **enitescens**
No detached silvery spot near apex, but costal spot curving toward apex in the middle of the wing ..... (48) **argentosa**

Key to the Species of Elachista Based on Male Genitalia[13]

I. Uncus lobes with few or no setae; setae if present, marginal; free outgrowth of harpe from near middle ..... Section I, species 1–19

1. Marginal setae of uncus long, exceeding the breadth of the lobes (7) **controversa**
Marginal setae of uncus, if present, short 2

2. Sacculus processes very short, half dumb-bell shaped; vinculum with a broad quadrate anterior projection ..... (6) **aurocristata**
Sacculus processes and vinculum otherwise 3

3. Lobes of ventral plate of anellus narrow elongate, several times longer than broad 4
Lobes of anellus, if long, not narrow 6

4. Lobes of anellus posteriorly produced into very long slender sclerotized rods ..... (19) **patriodoxa**
No such sclerotized rods 5

[13] Omitted from the key: *spatiosa* n. sp., *lamina* n. sp., *sincera* Braun, *parvipulvella* Chambers in Section I; *pusilla* F. & B., *unifasciella* Chambers, *maculoscella* (Clemens), *staintonella* Chambers, *texanica* F. & B., *inaudita* Braun in Section II.

5. Anellus lobes parallel-sided, truncate ..... (18) **hiberna**
   Anellus lobes with produced rounded apices ..... (1) **epimicta**
6. Each lobe of anellus produced laterally into a long prong (11) **acenteta**
   Anellus lobes otherwise 7
7. Each anellus lobe deeply sinuate and produced posteriorly at the side into an elongate lobe ..... (2) **symmorpha**
   Anellus lobes otherwise 8
8. Aedeagus a short cylinder; no cornutus ..... (17) **coniophora**
   Cornuti present; aedeagus not a short cylinder 9
9. Cornutus a long, slender, acute spine 10
   Cornutus blunt, or if acute, short 11
10. Sacculus process broad, flattened ..... (8) **albella**
    Sacculus process slender ..... (13) **purissima**
11. Cornutus arising from a sclerotized base 12
    No sclerotized base 14
12. Sclerotized base broad and bluntly produced beyond origin of cornutus; cornutus a curved stout spine ..... (9) **adempta**
    Sclerotized base narrow, elongate 13
13. Anellus lobes posteriorly broadly rounded; gnathos broadly ovate (12) **hololeuca**
    Anellus lobes obliquely truncate; gnathos elongate, tongue-like (10) **griseicornis**
14. Sclerotized lateral margins of anellus produced beyond posterior margin of each lobe ..... (3) **orestella**
    Sclerotized lateral margins of anellus extended laterally at the dorsolateral angle of each lobe; lobes acutely rounded posteriorly (4) **synopla**

II. Uncus lobes setose, the setae distributed over at least half the surface (see also III) ..... Section II, species 20–45

1. Gnathos two spined knobs 2
   Gnathos a single spined knob 6
2. Ventral margin of harpe at apex produced into a strong spine 3
   Apex of harpe without spine 4
3. Anellus lobes rounded at apex, a few short setae ..... (41) **tanyopis**
   Posterior margin of anellus lobes thickened, broadly rounded, no setae (42) **salinaris**
4. Uncus deeply cleft, lobes narrow, elongate, setose on posterior half only ..... (34) **leucosticta**
   If uncus cleft, the lobes not elongate 5
5. Uncus not cleft; outgrowth of harpe greatly developed, fusing with costa to form an inflated pocket ..... (32) **cucullata**
   Uncus cleft, outgrowth of harpe free ..... (33) **agilis**

6. Sacculus processes minute, spoon-shaped, without setae 7
Sacculus processes not minute; elongate, club-shaped, or flattened .. 8
7. Cornuti a mass of microscopic spines ..... (44) **solitaria**
Cornuti a row of minute spines ..... (45) **radiantella**
8. Sacculus process a slender rod without setae; cornuti a mass of microscopic spines ..... (43) **praelineata**
Sacculus process setose; cornuti if present not a mass of microscopic spines 9
9. No cornutus 10
Cornuti present 12
10. Tip of aedeagus thickened, strongly sclerotized, and bifid (20) **irrorata**
Tip of aedeagus, if emarginate, not thickened 11
11. Anellus lobes broad, obliquely truncate, dorso-lateral angle pronounced (30) **sylvestris**
Anellus lobes narrow, dorso-lateral angle obsolete .. (31) **nitidiuscula**
12. Cornutus a single spine; anellus lobes tapering to the pointed apices, dorso-lateral angles obsolete 13
Cornuti two or more spines; anellus lobes either pointed or truncate . 16
13. Sacculus processes club-shaped 14
Sacculus processes broad, laterally flattened 15
14. Vinculum gradually tapering to an acute anterior projection; apex of each anellus lobe posteriorly acutely produced .. (26) **excelsicola**
Vinculum with an abrupt blunt anterior projection .. (27) **stramineola**
15. Uncus lobes widely separated, the space between them quadrate, wider than long ..... (38) **cana**
Uncus lobes less widely separated, the space between them parabolic, longer than wide ..... (39) **amideta**
16. Cornuti, not more than two spines 17
Cornuti consisting of one spine, and a group of several spines 18
17. Cornuti, a broad-based acute spine and a similar minute spine beyond it (22) **oxytypa**
Cornuti, a blunt tooth-like spine and a slender acute spine beyond it (21) **fuliginea**
18. Anellus lobes tapering to the pointed apices; dorso-lateral angles obsolete ..... (36) **maritimella**
Anellus lobes obliquely truncate; the lobes broad, dorso-lateral angles pronounced 19
19. Uncus lobes very widely separated; cornuti, one acute spine and a couple of unequal blunt spines ..... (29) **albicapitella**
Uncus lobes less widely separated; cornuti, one blunt spine and a cluster of one longer and several shorter acute spines .. (28) **leucofrons**

III. Uncus lobes with short setae, either marginal or widely spaced; free outgrowth of harpe reduced to an acute projection at base of harpe; aedeagus lobed at base, pronged or acutely produced at apex
Section III, species 46–48

1. Aedeagus with a blunt lobe or prong above middle; gnathos ovate or broader than long 2
Aedeagus without such prong; gnathos ellipsoidal ... (48) **argentosa**
2. Aedeagus short, wide, middle lobe of base tapering to a rounded point (46) **madarella**
Aedeagus longer, slender toward apex; middle lobe of base quadrate (47) **enitescens**

Key to the Species of Elachista Based on Female Genitalia[14]

1. Bursa copulatrix without signum 2
Bursa copulatrix with signum 9
2. Membrane of bursa copulatrix entirely smooth 3
Membrane of bursa copulatrix minutely spiculate 4
3. Ostium very small, round ..... (45) **radiantella**
Ostium broadly oval ..... (43) **praelineata**
4. Ovipositor lobes thin, blade-like, strongly sclerotized ..... (14) **lamina**
Ovipositor lobes normal 5
5. Bursa copulatrix elongate oval, gradually passing posteriorly into the short ductus bursae ..... (17) **coniophora**
Bursa not elongate oval, or if more or less elongate, then ductus bursae narrow at origin and much longer than the bursa 6
6. Walls of posterior two-thirds of ductus bursae greatly thickened, ductus constricted before ostium ..... (15) **sincera**
Walls of ductus bursae, if sclerotized, not thickened 7
7. Ductus bursae not dilated before ostium; ostium small, rounded 8
Ductus bursae dilated before ostium; ostium wide; teeth of ductus bursae minute, numerous ..... (11) **acenteta**
8. Ductus bursae narrow immediately posterior to bursa and coiled *in situ;* dentate strip a double row of teeth ..... (8) **albella**
Ductus bursae nowhere coiled; teeth in a single row ..... (9) **adempta**
9. Signa two 10
Signum single 12
10. Signa two spiral spined bands ..... (6) **aurocristata**
Signa not spiral 11

[14] Omitted from the key: *symmorpha* n. sp., *synopla* n. sp., *controversa* Braun, *parvipulvella* Chambers in Section I; *pusilla* F. & B., *unifasciella* Chambers, *maculoscella* (Clemens), *agilis* Braun, *staintonella* Chambers, *cana* Braun, *amideta* n. sp., *leucosticta* n. sp., *texanica* F. & B., *salinaris* Braun, *solitaria* Braun in Section II.

11. Signa two elongate spindle-shaped finely dentate patches ... (18) **hiberna**
Signa two narrow acuminate marginally dentate plates .. (19) **patriodoxa**
12. Signum a dentate knife-like ridge on a sclerotized base 13
Signum not a dentate ridge 14
13. Sclerotized base of signum diamond-shaped ..... (41) **tanyopis**
Sclerotized base of signum elongate oval ..... (40) **inaudita**
14. Dorsal posterior margin of the eighth abdominal segment fringed with strong setae 15
No such setae on the dorsal posterior margin of the eighth abdominal segment 17
15. Bursa copulatrix small; signum a small oval dentate patch .. (47) **enitescens**
Bursa larger, bilobed, signum large 16
16. Depressed membranous area around ostium emarginate posteriorly; signum a broad dentate band ..... (46) **madarella**
Depressed membranous area around ostium evenly oval; signum a longer narrow dentate band ..... (48) **argentosa**
17. Signum a dentate band or crescent 23
Signum circular or irregular 18
18. Ductus bursae enormously dilated before ostium; ostium nearly as broad as the eighth segment ..... (5) **spatiosa**
Ductus bursae not abnormally dilated before ostium; ostium not over one-third the breadth of the eighth segment 19
19. Ductus bursae very long, without teeth or at most with one or two teeth .. 20
Ductus bursae not unusually long, the membrane armed with longitudinal rows or bands of teeth 21
20. Ductus bursae longer than the body and several times coiled; signum a large circular dentate patch ..... (1) **epimicta**
Ductus bursae not longer than the body; signum small, three of the teeth larger than the others ..... (13) **purissima**
21. Outer surface of the ductus bursae for two-thirds its length with numerous close-set teeth ..... (3) **orestella**
Inner surface of the ductus bursae with a longitudinal row of teeth 22
22. Dilated part of ductus bursae before ostium cup-shaped .. (10) **griseicornis**
Dilated part of ductus bursae before ostium abruptly flaring, membranous (12) **hololeuca**
23. Signum crescentic 24
Signum a band 29
24. Signum an angled crescent; no teeth at inception of ductus seminalis .. 25
Signum not angled, narrow, elongate, acute at each end; four dentate knobs at inception of ductus seminalis ..... (26) **excelsicola**
25. Ductus bursae sclerotized from ostium anteriorly at least to middle of segment 6 26
Ductus bursae at most sclerotized from ostium only to posterior margin of segment 6 28

26. Dilated part of ductus bursae before ostium cylindrical, sides parallel (36) **maritimella**
Dilated part of ductus with the sides diverging toward ostium 27
27. Ductus bursae sclerotized to middle of segment 6; ostium spinulate, the spinules shorter than their distance apart ..... (20) **irrorata**
Ductus bursae sclerotized nearly to anterior margin of segment 6; ostium spinulate, the spinules longer than their distance apart .. (21) **fuliginea**
28. Ostium at the anterior margin of the genital plate ..... (22) **oxytypa**
Genital plate produced at ostium as a strongly sclerotized anterior lobe; hairs of ovipositor short and thick ..... (32) **cucullata**
29. Genital plate produced mid-ventrally, indenting the seventh segment, the produced sides parallel; ostium at its anterior margin (27) **stramineola**
Genital plate not so produced mid-ventrally 30
30. Ventral margin of ostium deeply concave, two lateral acute rods; ostium sclerotized dorsally 31
Ventral margin of ostium not deeply concave; ostium dorsally membranous, finely spinulate 32
31. Signum a broad, somewhat dumb-bell shaped plate ..... (30) **sylvestris**
Signum a narrow sinuate band ..... (31) **nitidiuscula**
32. Dilated portion of ductus bursae before ostium a truncated cone; 3 teeth at inception of ductus seminalis ..... (29) **albicapitella**
Dilated portion of ductus bursae before ostium tub-shaped; 2 teeth at inception of ductus seminalis ..... (28) **leucofrons**

Section I

(1) **Elachista epimicta** new species (Figs. 6, 15, 39, 61, 61a, 107.)

1920. *Elachista orestella* Braun (not Busck), Ohio Journ. Sci., xx, 171, 172.

1921. *Elachista orestella* Braun (not Busck), Ohio Journ. Sci., xxi, 209.

1923. *Aphelosetia orestella* Forbes (not Busck) in part, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 220.

1933. *Elachista orestella* Braun (not Busck), Trans. Am. Ent. Soc., lix, pp. 238, 241, *et al.*

Head white, palpi white, the second segment outwardly shaded with dark fuscous, more deeply so in the male; antennae whitish, with indistinct slightly darker annulations, most noticeable in the female. Fore wings white, sometimes a faint ocherous shade along costa; on the fold at 4/5 its length a brownish or blackish spot, variable in size and somewhat irregular; at end of cell a similar spot, often smaller than the plical spot, and sometimes absent; except for these two spots, the wings may be immaculate pure white, or there may be widely scattered pale fuscous scales, which rarely (in males) tend to be arranged in lines. Cilia white, the row of scales around apex minutely black-tipped, the

black tips forming a fine even line through the cilia; this line is at least partially indicated even in the whitest specimens. Hind wings in the female varying from almost pure white to faintly grayish ocherous tinged; much darker in the male, pale ocherous fuscous. Legs yellowish white, the fore legs inwardly shaded with dark fuscous. Abdomen white, shaded more or less with pale ocherous fuscous.

Alar expanse: 10 to 13 mm.

Male genitalia (figs. 61, 61a): uncus lobes with a few short marginal setae; gnathos ellipsoidal; anellus very deeply cleft, the lobes slender and elongate, obtusely angled dorso-laterally at the point of articulation with the outgrowth from harpe, setose toward tip; sacculus processes long, slender; vinculum produced, the produced sides parallel; aedeagus large, broad at base, tapering to the narrow apex; cornutus a very long acutely pointed spine.

Female genitalia (fig. 107): bursa copulatrix in the second abdominal segment, spiculate, signum a large nearly circular dentate patch; ductus bursae very long (longer than the body), narrowing and several times coiled, then gradually widening to near ostium where, after the inception of the ductus seminalis, it abruptly narrows and is strongly sclerotized to the small circular ostium.

Type.—♂, Cincinnati, Ohio, under rearing record B.975, imago May 12, 1918, [A. F. B. Coll.].

Allotype.—♀, Cincinnati, Ohio, under rearing record B.975, imago May 16, 1918, [A. F. B. Coll.].

Paratypes.—10 ♂, 8 ♀, Cincinnati, Ohio, under rearing record B.975, with dates of emergence from May 10 to 16, 1918, [A. F. B. Coll. and A. N. S. P.]; 1 ♂, Cincinnati, Ohio, rearing record B.1032, imago May 5, 1920, 1 ♀, rearing record B.1033, imago May 5, 1920; 4 ♂, 2 ♀, Cincinnati, Ohio, taken on the wing, May 16 to June 1, [A. F. B. Coll. and U. S. N. M.].

The preferred food plant is *Hystrix patula* Moench.; mines also occur on *Elymus* spp. The larva mines the basal overwintering leaves from October or November until May of the following spring. The mine at first lies near the upper epidermis (which by a twist in the leaf faces downward in *Hystrix*); part way along the length of this early mine, the epidermis is wrinkled, drawing the leaf into a fold several centimeters long where the leaf tissue is not consumed. Later the mine broadens and may be several inches long; here the leaf tissue is consumed and the epidermis of the mine grayish. Occasionally the larva makes a second mine, entering at the tip of the leaf, and consuming all the leaf tissue within the mine. The larva is pale greenish yellow or

grayish; the prothoracic shield with two rather broad dorsal stripes, posteriorly darkening and each ending in a black spot.

Pupa (fig. 39) in a slight cocoon, cuticle shining.

The figure (pl. II, fig. 15) illustrates the typical venation of this section, with veins R_4 and R_5 of the fore wing stalked, and cell of the hind wing closed, with the medial stem partially preserved.

This is our broadest-winged white species.

Small females marked only with the plical and discal dots, and with white hind wings are almost indistinguishable from *E. orestella* Busck. In *E. orestella,* however, a few dark scales projecting into the cilia at tornus are almost always present, and the plical spot is situated at ⅔ the length of the fold. On genitalic characters the two species are abundantly distinct. The usual wing expanse of *epimicta* is greater than that of *orestella.*

Through an unfortunate misidentification of this species as *orestella* Busck, a number of references to it as *orestella* have crept into the literature; all of my previous remarks on eastern specimens under the name *orestella* refer to *E. epimicta.* The remarks on the early stages of *E. orestella* in Forbes, Lepidoptera of New York, apply to this species, not to *E. orestella.*

(*2*) **Elachista symmorpha** new species (Figs. 60, 60a.)

Head white, palpi white, the third segment very slender and acute. Thorax and fore wings white; a very faint ocherous tinge along costa and in the apical third of the wing; in this costal area and in the apical half of the wing there are scattered minutely brown-tipped scales. In the fold at two-thirds its length, dark brown scales form an irregular spot; at the end of the cell a larger elongate oval dark brown spot; on the dorsal margin obliquely basad of the discal spot, an irregular group of dark brown scales; scales at the apex of the wing broadly dark brown-tipped, forming a more or less irrorated dark patch; scattered dark scales along termen; the brown tips of the elongate scales at apex and along termen form a distinct dark line in the cilia. Hind wings and cilia pale straw-colored. Legs white, fore pair dark fuscous inwardly; tarsi except tips inwardly fuscous. Abdomen pale ocherous, shaded with fuscous.

Alar expanse: 12 to 13 mm.

Male genitalia (figs. 60, 60a): uncus lobes very small; costal margin of harpe nearly straight; sacculus processes very stout, setose, not exceeding the anellus lobes; posterior margin of each anellus lobe strongly sinuate and produced at each side into an elongate posterior lobe, setose from apex to the lateral angle; vinculum not produced; aedeagus produced into a blind sac at

base; cornuti consisting of an elongate sclerotized base bearing several small teeth and culminating in a larger conical tooth, and a group of numerous minute triangular spines near apex.

Type.—♂, Monache Meadows, Tulare County, California, 8000 feet, July 1–7, [No. 34826, U. S. N. M.].

Paratypes.—1 ♂, same data as the type, [U. S. N. M.]; 1 ♂, without abdomen, same locality, July 11, 1917, [A. F. B. Coll.].

Food plant and early stages unknown.

In wing markings this species comes nearest to the eastern *orestella* Busck, agreeing with it in the presence of the cluster of dark scales on dorsum near the end of the fold; it is, however, somewhat larger and of different aspect. Differences in the male genitalia, especially in the shape of the anellus lobes, in aedeagus and cornuti separate the two species.

(3) **Elachista orestella** Busck (Figs. 62, 62a, 111, 111a.)

1908. *Elachista orestella* Busck, Canad. Ent., XL, 196. Type ♀ (without abdomen), Oak Station, Allegheny County, Pennsylvania, [U. S. N. M., Type No. 11563].

1923. *Apheloscetia orestella* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 220 (in part).

Head and palpi typically pure white (second segment of palpus in male sometimes shaded outwardly with fuscous); antennae white near base, shading to fuscous at tips. Thorax and fore wings usually pure white, faintly shining, rarely with a faint yellowish tinge especially along costa; at two-thirds the length of the fold an elongate black spot, and obliquely above it at the end of the cell, a similar, but usually smaller black spot; on the dorsal margin, just basad of the end of the fold, a cluster of blackish or fuscous-tipped scales is almost always present; there may be a few fuscous-tipped scales scattered over the wing surface, usually confined to the apical third of the wing, but in one male, the number of these dark-tipped scales is greatly increased, and they occur over the entire wing surface and form ill-defined patches around the black spot at end of cell, at apex and along termen near tornus. Cilia white, in the darkest specimen pale fuscous toward tips; the marginal row of scales around apex and along termen usually black tipped, the tips forming a fine dark line in the cilia from costa before apex nearly to tornus. Underside of fore wings usually white, sometimes faintly ocherous. Hind wings and cilia white in both sexes; rarely with a faint ocherous tinge. Legs white, more or less shaded with fuscous, fore pair fuscous inwardly. Abdomen white, with slight fuscous shading.

Alar expanse: 9.5 to 11 mm.

Male genitalia (figs. 62, 62a): uncus lobes with a few short marginal setae; gnathos elongate oval; harpe broad, costal margin thickened, sacculus processes stout, dorsally obtusely angulated; lateral margins of anellus strongly sclerotized and produced beyond the posterior margin of each lobe, which bears a group of a few short setae; vinculum broadly rounded; aedeagus tapering, cornutus a curved spine.

Female genitalia (figs. 111, 111a): bursa copulatrix pear-shaped, signum consisting of three connected teeth and one or two smaller teeth on an elongate spined patch; in addition, two elongate finely spinulate patches, one dorsal and one ventral; outer surface of ductus bursae from the bursa into segment 7 with a broad longitudinal dentate band; a short membranous portion follows, then a sclerotized band before the opening into a spinulate depression of the genital plate.

Specimens examined: 11 ♂, 7 ♀.

PENNSYLVANIA: Oak Station, Allegheny County, ♀ type, June 11, 1907 (Fred Marloff), [U. S. N. M.]; 3 ♂, May 21, 1911 (F. Marloff), [U. S. N. M.], 1 ♂, same date, [M. C. Z.]; Hazleton, 1 ♀, 5–18–97 (W. G. Dietz), [M. C. Z.].

NEW YORK: Ithaca, 1 ♂, 11 Aug., 1924 [J. R. Eyer Coll.]; Perry, 1 ♂, 14 Aug., 1918 [J. R. Eyer Coll.]; "Cent. N. Y.," 2 ♀, 6–1–99 and 6–9–99 [M. C. Z.]; Ramapo, 1 ♂ May 27, 1900 (W. D. Kearfott), [U. S. N. M.].

NEW JERSEY: Essex Co. Pk., 2 ♂, July 22 and Sept. 7, 06, Trap (W. D. Kearfott), [U. S. N. M.].

MASSACHUSETTS: Cohasset, 2 ♂, July 2, 07 (Owen Bryant), [U. S. N. M.].

QUEBEC: "Westmt," 1 ♀ (A. F. Winn), [U. S. N. M.].

ILLINOIS: Chicago, 2 ♀ [M. C. Z.].

Food plant and early stages unknown.

Elachista orestella may be separated on adult markings from *E. epimicta* by the more basad position of the plical spot, by the cluster of dark scales on the dorsal margin near the end of the fold, and by the white hind wings of both sexes. The single darker male (referred to in the description) from Essex County Park, N. J., July 22, agrees exactly in genitalic characters with typical white males. Genitalic characters of both sexes suggest relationship to *acenteta* Braun.

In Forbes, Lepidoptera of New York, page 220, the description of the adult moth applies to *orestella*, the remarks on food plant and early stages apply to *epimicta*.

(4) **Elachista synopla** new species (Fig. 63.)

1925. *Elachista orestella* Braun (not Busck), Trans. Am. Ent. Soc., LI, 210.

Head white, palpi white, antennae white at base, shading to gray at tips. Thorax and fore wings white; at two-thirds the length of the fold, below but

close to it, a group of dark brown scales (sometimes reduced to two or three scales) forms an irregular spot; a similar group of scales at the end of the cell. There may be scattered minutely dark-tipped scales in the apical half of the wing; dark-tipped scales may form a broken line in the cilia around apex and scattered black specks in the cilia along termen toward dorsum; or these dark-tipped scales may be absent, and the plical and discal spots only present. Hind wings pure white or faintly dusted, cilia sometimes tinged with ocherous. Under surface of both wings sometimes dusted with pale ashy scales. Legs white, more or less dusted with pale ashy scales.

Alar expanse: 11 to 12.5 mm.

Male genitalia (fig. 63): uncus lobes without setae; gnathos elongate; costal area of harpe broad, sacculus processes clavate, slender at base; lateral margins of anellus sclerotized and dorso-lateral angle of each lobe extended as a sclerotized acute projection, apex of each lobe sharply rounded, setose; vinculum rounded; aedeagus tapering, cornutus an acutely pointed spine.

Type.— ♂, Logan Canyon, Cache County, Utah, altitude 6000 feet, July 16, 1924 [A. F. B. Coll.].

Paratypes.—2 ♂, same data as the type; 1 ♂, Yellowstone National Park, Wyoming, near Old Faithful, July 4, 1924 [A. F. B. Coll.].

Food plant and early stages unknown.

E. synopla is closely allied to *orestella* Busck and *symmorpha* Braun; in wing markings it differs from both by the irregular plical and discal spots, and absence of dark scales on dorsum at tornus; in male genitalia by the different shape of the anellus lobes, the more slender sacculus processes, and from *orestella* by the broader thinner costal area of the harpe. From *symmorpha* it is further separated by the excavated costa of the harpe and by differences in aedeagus and cornuti.

(5) **Elachista spatiosa** new species (Fig. 109.)

Head, palpi white, antennal scape white, stalk with alternate white and pale ashy fuscous annulations. Fore wings white, with a scattering of microscopically ocherous-tipped scales; these are most noticeable in the costo-apical half of the wing. A few brownish scales form an ill-defined spot at 4/5 of fold; a similar spot at end of cell. A few elongate brownish-tipped scales project into the cilia at apex and along termen. Hind wings and cilia white with a faint ocherous tinge in some lights. Legs pale ocherous-tinged with fuscous shading on the fore and middle pair.

Alar expanse: 11 mm.

Male unknown.

Female genitalia (fig. 109): bursa copulatrix spiculate, the signum a group of longer and heavier spines on a thickened circular area; ductus bursae

minutely dentate near bursa, posteriorly somewhat inflated, with longitudinal sclerotized strips; ductus seminalis spinulate, arising at a slight contraction of the ductus bursae; the ductus bursae enormously enlarged before ostium, which is nearly the breadth of the eighth segment and is margined by a strongly sclerotized band widest mid-ventrally and interrupted mid-dorsally by a membranous spinulate patch.

Type.— ♀, Loma Linda, San Bernardino County, California, June 6, 1912 (G. R. Pilate), [A. F. B. Coll.].

Food plant and early stages unknown.

E. spatiosa is nearest to *E. aurocristata* in wing aspect, but the very different female genitalia at once separate the two species.

(6) **Elachista aurocristata** Braun (Figs. 66, 108.)

1921. *Elachista aurocristata* Braun, Proc. Acad. Nat. Sci. Phila., LXXIII, 16. Type ♂, Glacier National Park, Montana [A. F. B. Coll.].

Head and palpi white, antennae white, shading outwardly to fuscous in the male. Thorax white. Fore wings, $R_4 + R_5$ forking well before costa, white with a scarcely perceptible creamy tinge; either immaculate or with a few scattered brownish ocherous scales; one or two such scales at 4/5 of fold, at end of cell, and at apex; a few scattered along termen; a fine faint blackish line in the cilia around apex and along termen. Hind wings white or faintly tinged with pale fuscous. Legs white, shaded with fuscous. Abdomen white, shaded with fuscous, anal segments ocherous tinged.

Alar expanse: 12 mm.

Male genitalia (fig. 66) characterized by the distinctive shape of the pointed lobes of the anellus, the very short, half dumb-bell shaped sacculus processes, the quadrate anterior projection of the vinculum and the lobed base of aedeagus; cornutus a heavy spine.

Female genitalia (fig. 108): bursa copulatrix smooth, elongate, gradually narrowing into the tapering ductus which is sclerotized from the inception of the ductus seminalis in segment 7 to the rounded ostium; signa, two spiral spined bands; lobes of the ovipositor small and rounded.

Specimens examined: 2 ♂, 2 ♀.

MONTANA: Glacier National Park, Glacier Park Station, ♂ type, 1 ♂ paratype, 1 ♀ paratype, July 29, 1920; 1 ♀ paratype, July 14, 1920 [A. F. B. Coll.].

Food plant and early stages unknown.

The moths were taken flying in the dry meadows at an altitude of about 5000 feet.

Although the moths are superficially scarcely distinguishable from the other white species, the very characteristic genitalia in both sexes at once separate them from all other species.

(7) **Elachista controversa** Braun (Fig. 65.)

1923. *Elachista controversa* Braun, Trans. Am. Ent. Soc., XLIX, 119.
Type ♂, Monache Meadows, Tulare County, California [A. F. B. Coll.].

Head and palpi white, antennae white at base, shading outwardly to gray. Thorax white. Fore wings, R_4 and R_5 separating well before costal margin; pure white, with a few light brown scales (from three or four to eleven or twelve) scattered irregularly in the outer half of the wing. Hind wings very pale gray, with a faint brownish tinge; cilia white, faintly ocherous-tinged at bases. Under surface of both pair of wings darker. Legs white, fore pair fuscous inwardly, middle and hind tarsi with a little fuscous shading. Abdomen white.

Alar expanse: 11 to 12.5 mm.

Male genitalia (fig. 65): uncus lobes large, fringed on the outer margins with long inwardly directed setae; gnathos large, broadly oval; costa of harpe excavated, sacculus processes broadest before apex; anellus lobes setose at apex, obliquely truncate, lateral angles somewhat produced; vinculum abruptly pointed, not produced; aedeagus somewhat tapering, cornutus a short, broad, blunt tooth-like spine, bent at apex, and bearing on its surface several minute teeth.

Specimens examined: 9 ♂, 3 sex undetermined (without abdomens and unspread).

CALIFORNIA: Monache Meadows, Tulare County, 8000 feet, ♂ type, 2 ♂ paratypes, July 10, 1917; 1 ♂ paratype, July 11, 1917 [A. F. B. Coll.]; 5 ♂, 3 sex undetermined, July 1–7 [U. S. N. M.].

Food plant and early stages unknown.

From *albella* (Chambers) and *adempta* Braun, in both of which a few darker scales are scattered over the outer half of the wing, *controversa* is at once distinguished by the separation of R_4 and R_5 well before reaching costa; in both of the other species R_4 and R_5 are united to the wing margin. In male genitalia, the large uncus lobes with long marginal setae separate it from all other white species. The female is unknown.

(8) **Elachista albella** (Chambers) (Figs. 70, 121.)

1875. *Phigalia albella* Chambers, Canad. Ent., VII, 107. Type locality, Texas.
1880. *Phigalia albella* Chambers, Journ. Cin. Soc. Nat. Hist., II, p. 203, fig. 28.
1903. *Aphigalia albella* Dyar, Bull. 52, U. S. N. M., p. 544.
1939. *Aphigalia albella* McDunnough, Checklist of Lepidoptera, No. 9049.

Head white, palpi white, rather long and curved, the second segment slightly swollen before apex, and sometimes shaded outwardly with fuscous, third segment slender, acute. Antennae white near base, shading outwardly to pale gray,

basal segment with pecten of long hair-like scales. Fore wings, R_4 and R_5 coincident; white, with scattered brown scales in the apical half of the wing, varying in number from a very few (in the female and in some males) to fifteen or twenty (in some males), several of which may project irregularly into the cilia of the termen. Cilia white. Hind wings and cilia pale fuscous ocherous in the male, white in the female. Legs white, fore pair inwardly fuscous, hind tibiae and hairs shining white. Abdomen pale fuscous ocherous.

Alar expanse: 12 to 12.5 mm.

Male genitalia (fig. 70): tegumen elongate between gnathos and uncus, uncus lobes with a few marginal setae; gnathos elongate; sacculus processes large, laterally flattened, broadest before apex, setose; anellus lobes with the setae grouped at apex; vinculum rounded; aedeagus slender, cornutus a long acute spine.

Female genitalia (fig. 121): bursa copulatrix with scattered spicules, no signum; ductus bursae densely spiculate over one-half the surface near bursa, then coiled *in situ*, membrane thickened in the coils; posterior to the coils abruptly dilated, with a sclerotized strip dentate on each side; thence narrowing at the inception of the granular ductus seminalis; ostium small, rounded; lobes of ovipositor elongate.

Specimens examined: 9 ♂, 1 ♀

Colorado: "Colo., 2139," 1 ♂; "Colo., 2126," 1 ♀ [U. S. N. M.]; Denver, 1 ♂, "197"; Fort Collins, 4 ♂, 6–16–96 [M. C. Z.].

Arizona: White Mts., Apache Ind. Res., el. 7000 ft., 1 ♂, 1–15 Jn. 25 (O. C. Poling), [U. S. N. M.].

Iowa: Sioux City, 1 ♂, May, 1927 (C. N. Ainslie), [U. S. N. M.].

Alberta: Lethbridge, 1 ♂, 8.VII.32 (R. M. White), [C. N. Coll.].

Food plant and early stages unknown.

The type of *Phigalia albella* Chambers is apparently no longer in existence; it could not be located at the Museum of Comparative Zoology. *Elachista* (*Phigalia*) *albella* (Chambers) has priority over *Elachista* (*Laverna*) *albella* (Chambers) by a few months.

Chambers' generic description of *Phigalia* in no way disagrees with characters of this section of the genus, in which veins R_4 and R_5 of the fore wing may be coincident, and the second palpal segment thickened or slightly roughened (cf. fig. 6); the venation and shape of the hind wing as described is typically that of this section of the genus. The figure given by Chambers shows veins R_5 and M_1 of the hind wing separate and closely approximate toward origin, an error easily accounted for by Chambers' poor draftsmanship.

The specimens herein identified as *albella* all agree with Chambers' description of the species. In some of the specimens examined, there

is a slight bend in vein R_{4+5} near costa, and the suggestion of a vestigial spur.

Male genitalia of three specimens, "Colo. 2139," White Mts., Arizona, and Lethbridge, Alberta agree exactly.

The type locality of *Phigalia albella,* Texas, probably Bosque County, is in a grassland region; all of the localities in which the specimens listed above were collected are, with the possible exception of the Arizona locality, in grassland regions.

Elachista albella and the following species (*adempta* Braun) are very closely related; differentiating characters are given under that species.

In both the United States National Museum and the Museum of Comparative Zoology, *Elachista albella* has been erroneously identified as *Butalis* (*Scythris*) *albapennella* Chambers, presumably by Walsingham, as both the male and female at the United States National Museum bear his label, and one Fort Collins, Colorado male at the Museum of Comparative Zoology bears his label, "273A, Wlsm.1898." *Butalis* (*Scythris*) *albapennella* Chambers is a true *Scythris,* as an examination of the type demonstrates.

Phigalia (*Aphigalia*) *ochremaculella* Chambers, described on the same page with *albella* is listed under the unrecognized species; no type is in existence. From the description, it does not appear to be an *Elachista.*

(9) **Elachista adempta** nom. nov. (Figs. 71, 71a, 120.)

1875. *Laverna albella* Chambers (pre-occ.), Cin. Quart. Journ. Sci., 11, 295. Type locality, Spanish Bar, Colorado.

1880. *Neaera albella* Chambers, Journ. Cin. Soc. Nat. Hist., 11, p. 203, fig. 40.

1903. *Mompha albella* Dyar, Bull. 52, U. S. N . M., p. 541.

1939. *Mompha albella* McDunnough, Checklist of Lepidoptera, No. 7745.

Head white, palpi white, shorter than in *albella* and tending to droop, third segment abruptly acute. Antennae white near base, shading outwardly to gray, basal segment with a pecten of long hair-like scales. Fore wings, R_4 and R_5 coincident; white, with a few scattered brown scales in the apical half of the wing, in some males several in the apex of the wing and projecting into the cilia, nearly or entirely immaculate in the female. Cilia white. Hind wings and cilia white in the female, cilia faintly tinged with ocherous in the male. Legs white, fore and middle pair shaded with fuscous, hind tibiae and hairs white, hind tarsi shaded with dark fuscous. Abdomen white.

Alar expanse: 11 to 12 mm.

Male genitalia (figs. 71, 71a): tegumen short between gnathos and uncus, uncus lobes with a few marginal setae; gnathos elongate; harpe shorter than in *albella,* sacculus processes flattened, broadly expanded and setose on the flat inner and outer surfaces; anellus lobes setose along the obliquely truncate posterior margins from apex to near the lateral angles; vinculum with a short acute anterior projection; aedeagus wider than in *albella,* cornutus a stout curved spine arising from a large broad sclerotized base which is bluntly produced beyond origin of the spine.

Female genitalia (fig. 120): bursa copulatrix lying in segments 3 and 4, spiculate, no signum; the ductus bursae, which is nowhere coiled *in situ,* enters in segment 3, the bursa appearing turned posteriorly; ductus in segments 3 and 4 with close-set, short, blunt nodules, then dilated, then gradually narrowing to the inception of the ductus seminalis, narrow and sclerotized from thence to the small rounded ostium; in the middle portion of the ductus bursae the membrane is armed with a longitudinal series of small, blunt teeth, arising from rounded sclerotized bases, anterior to these, a group of numerous minute teeth; lobes of ovipositor rounded.

Specimens examined: 2 ♂, 3 ♀.

Colorado: Denver, 1 ♂, "97" [W. G. Dietz Coll. in M. C. Z.].

Utah: Stockton, 1 ♂, VIII–9–7; 3 ♀, V–20–7, VI–29–7, VII–1–7 (Tom Spalding), [W. G. Dietz Coll. in M. C. Z.].

Food plant and early stages unknown.

The type of *Laverna albella* Chambers could not be found at the Museum of Comparative Zoology. In describing the species, Chambers expressed doubt as to its generic position saying: "Probably not a true *Laverna* as the palpi are rather small and more like those of *Phyllocnistis.* The vertex is short . . . . " His figure of the venation is that of an *Elachista* of this section of the genus. My identification of the five specimens included under this species is based upon their short palpi, which [in shape and position] resemble those of some species of *Phyllocnistis.*

Elsewhere Chambers locates Spanish Bar at the mouth of the Fall River, altitude 7800 feet.

E. adempta is very close to *E. albella,* agreeing with it in wing venation and the scattering of brown scales on the fore wing. It differs from it by the shorter labial palpi; the palpi are about two-thirds as long in *adempta* as in *albella,* straighter and scarcely or not recurved. The greater length of tegumen and harpe in *albella* as compared to *adempta* can be observed in the dried insect. Characters of the geni-

talia of both sexes differentiate the two species, namely in the male, the very different cornuti and different arrangement of setae of the anellus lobes; in the female, the form and armature of the ductus bursae, which in *adempta* is nowhere coiled.

This species has also been confused with *Scythris albapennella* (Chambers). The Denver specimen bears that name on the label with "Wlsm." in red ink and the number "2764."

(10) **Elachista griseicornis** Meyrick (Figs. 69, 115.)

1932. *Elachista griseicornis* Meyrick, Exot. Microlep., IV, 218. Types, ♂, ♀, Muskoka, Ontario [B. M.].

Head white, palpi white, second segment sometimes with a slight gray shading beneath. Antennae dark gray, paler near base especially in the female, scape white; segments in the basal half shorter than broad and closely placed in the male with indication of serration only toward tip. Thorax and fore wings pure white, cilia white. Hind wings evenly pale gray, cilia white. Fore wings gray beneath, hind wings white beneath. Legs mostly white, some dark shading on the fore and middle pair. Abdomen above fuscous, beneath paler, posterior margins of segments whitish.

Alar expanse: 7 to 10 mm.

Male genitalia (fig. 69): uncus lobes cleft to suture, close together, a few marginal setae; gnathos elongate, tongue-shaped and pointed; harpe broad, apex broadly rounded; sacculus processes stout, laterally flattened, but appearing club-shaped when viewed ventrally, setose; anellus lobes obliquely truncate and fringed with short setae; sclerotized band of vinculum narrow, shortly produced to a blunt point; aedeagus swollen at base, tapering to slender apex, cornutus a heavy short spine arising from an elongate sclerotized base.

Female genitalia (fig. 115): bursa copulatrix lying in segments 3 and 4 and projecting slightly into segment 2, spiculate, signum a sub-triangular patch of large transversely placed teeth and numerous small teeth; ductus bursae long, narrowing toward ostium, its anterior three-quarters membranous and armed with longitudinally placed groups of strong teeth; posterior fourth sclerotized, dilated portion before ostium cup-shaped and constricted at ostium.

Specimens examined: 4 ♂, 2 ♀.

Ontario: Blackburn, 2 ♂, 22–V–1941 (J. McDunnough); S. March, 2 ♀, 2–VI–1941 (T. N. Freeman), [C. N. Coll.].

Quebec: Kazubazua, 1 ♂, 7–10, VI, 1927 (J. McDunnough), [C. N. Coll.].

Minnesota: Chisago County, 1 ♂, 5/14, 22 (J. R. Eyer), [J. R. E. Coll.].

Food plant and early stages unknown.

The dark gray antennae with short and closely placed segments in the male and the more evenly gray hind wings may serve to separate

this species from the following superficially very close species. By genitalic characters of both sexes they are at once easily separated.

Meyrick gives 7 to 9 mm. as the wing expanse; I have seen no specimens with wing expanse as little as 7 mm.

(11) **Elachista acenteta** new species (Figs. 67, 67a, 114.)

Head white, palpi white, narrowly gray on the second segment below. Antennae white, pale gray beneath, and grayish toward tip in male, scape white; slender, the segments longer than broad in both sexes, slightly serrate. Thorax and fore wings pure white above, cilia white; evenly dusted on the underside with pale ashy gray scales. Ground color of hind wings white, in the male evenly and closely dusted with pale ashy gray scales above and below, but paler on the underside, the veins showing as darker lines; in the female the dusting scarcely contrasting, the wings thus nearly pure white. Cilia white, with a faint yellowish tinge, especially toward their bases. Legs mostly white, fore and midd'e pair somewhat shaded with gray. Abdomen gray above, with posterior margins of segments whitish; whitish beneath.

Alar expanse: 9.5 to 10 mm.

Male genitalia (figs. 67, 67a): uncus lobes angulate outwardly, a few setae in the angles; gnathos broadly oval; free process of harpe overhanging a deep depression, sacculus processes laterally flattened, broadest before apex, setose; each lobe of anellus produced laterally into a long prong, setae in two groups; vinculum rounded, not produced; aedeagus produced into a blind sac at base, tapering to near the expanded apex; cornutus a branched leaf-like structure, one branch lanceolate, the other heart-shaped.

Female genitalia (fig. 114): bursa copulatrix lying diagonally in segments 4 and 5, spiculate; an elongate patch of heavier spicules suggests a signum; ductus bursae membranous in anterior third, a single coil near junction with the sclerotized and broader posterior two-thirds through which a broad finely dentate stripe runs; the ductus seminalis enters as a sclerotized tube just before the dilated part of the ductus bursae before ostium; the dilation heavily sclerotized at base and sides; ostium large, situated at the anterior margin of the genital plate.

Type.— ♂, Parrsboro, Nova Scotia, 29–VI–1944 (J. McDunnough), [C. N. Coll., Type No. 5734].

Allotype.— ♀, same data as the type, [C. N. Coll., Type No. 5734].

Paratypes.—2 ♂, 3 ♀, same data as the types; 3 ♂, Ottawa House, Parrsboro, 30–VI–1944 and 5–VII–1944 (J. McDunnough), [C. N. Coll., No. 5734].

The moths were taken on the marshes at Parrsboro, Dr. McDunnough informs me.

Food plant and early stages unknown.

E. acenteta and *E. griseicornis* are the only known pure white eastern species; from *griseicornis* (as well as from all other species) *acenteta* is at once separated in both sexes on genitalic characters, especially the unique male genitalia with unusual shaped uncus lobes, anellus and cornutus. Superficially, the dusting of the hind wings and the paler, more slender antennae of *acenteta* are the only characters of separation.

(12) **Elachista hololeuca** new species (Figs. 72, 72a, 113.)

Head and palpi white, antennae white above, grayish toward tip and gray below. Fore wings shining white above, under surface pale gray. Hind wings very pale gray in the male, white in the female, cilia white in both sexes. Legs mostly white, some grayish shading on the fore and middle pair and on the hind tarsi. Abdomen white with grayish shading, genital segments white.

Alar expanse: 9.5 to 10 mm.

Male genitalia (figs. 72, 72a): uncus lobes with a marginal double row of short setae; cucullus of harpe narrow, sacculus processes elongate, densely setose; anellus lobes broadly rounded, upper margins with short setae; vinculum broadly rounded, not produced; aedeagus but little enlarged at base, broadest in the middle and tapering to apex; cornutus a blunt spine arising from an elongate sclerotized base.

Female genitalia (fig. 113): bursa copulatrix occupying segments 3 and 4, and extending into segment 2, spiculate, signum a dentate patch narrowing and produced posteriorly, the teeth progressively smaller posteriorly; ductus bursae with a spinulate streak near bursa and armed with a longitudinal row of teeth, narrowing and sclerotized in segment 7, then abruptly and broadly flaring to the wide ostium.

Type.—♂, Shingle Creek, Penticton (at the south end of Lake Okanagan), British Columbia, 7–VI–1933 (A. N. Gartrell), [C. N. Coll., Type No. 5735].

Allotype.—♀, Penticton, B. C., 7–VI–1933 (J. McDunnough), [C. N. Coll., Type No. 5735].

Paratypes.—2 ♂, Penticton, B. C. (J. McDunnough), [C. N. Coll., No. 5735].

Food plant and early stages unknown.

This species and the following two are indistinguishable except on genitalic characters.

In regard to the localities and habitats of these three species, Dr. McDunnough writes: "All the localities are fairly close to each other

at the southwestern end of Okanagan Lake in a semi-dry area. Penticton is at the extreme south end of the lake, Peachland and Summerland a little farther north on the western side and Garnett Valley is merely part of a road leading into the foothills west of Summerland, probably some five to ten miles distant."

(13) **Elachista purissima** new species (Figs. 68, 68a, 112.)

Head and palpi white, antennae white above, very pale gray below, a little longer and more slender toward apex than in the preceding species. Fore wings shining white above, under surface pale gray. Hind wings very pale gray, nearly white in the female; cilia white in both sexes. Abdomen white.

Alar expanse: 10 to 11 mm.

Male genitalia (figs. 68, 68a): uncus lobes small, a few short marginal setae; cucullus broad, sacculus processes elongate, more slender than in *hololeuca* and with fewer setae; anellus lobes very obliquely truncate, the rounded apex of each lobe with four setae; vinculum broadly produced; aedeagus straight, evenly tapering, cornutus a long slender acute spine.

Female genitalia (fig. 112): bursa copulatrix small, lying in the third segment, spiculate, signum a small, circular, irregularly dentate patch; ductus bursae narrow in segment 4, then widening to the middle of segment 7, thence narrow and sclerotized to the small ostium; about the middle of its length it bears a single strongly sclerotized tooth.

Type.— ♂, Garnett Valley, Summerland, British Columbia, 20–V–1934 (A. N. Gartrell), [C. N. Coll., Type No. 5736].

Allotype.— ♀, same data as the type [C. N. Coll., Type No. 5736].

Paratypes.—2 ♂, same data as the type [C. N. Coll., No. 5736].

Food plant and early stages unknown.

As noted under the description of the preceding species, these immaculate white species are indistinguishable except by genitalia. On these characters, the two species are amply distinct in both sexes.

(14) **Elachista lamina** new species (Fig. 110.)

Head white, palpi white, a little longer than in the two preceding species, antennae white, very slender. Fore wings white, a little less shining than in the two preceding species, under surface pale gray. Hind wings very pale gray, with white cilia. Legs white. Ovipositor of the female large, strongly sclerotized, and conspicuously projecting, lobes blade-like.

Alar expanse: 10 to 11 mm.

Female genitalia (fig. 110): bursa copulatrix in segments 3, 4 and part of 5, coarsely spiculate, no signum; ductus bursae spiculate near bursa, with one or two teeth in the membranous portion, narrowing and becoming sclerotized in

segment 7; ostium small, round, near middle of well-sclerotized genital plate; lobes of ovipositor very large, laterally flattened, thin and blade-like, very heavily sclerotized.

Type.—♀, Peachland, British Columbia (on Okanagan Lake), 27–VI–1935 (A. N. Gartrell), [C. N. Coll., Type No. 5737].

Paratypes.—2 ♀, same data as the type [C. N. Coll., No. 5737].

Food plant and early stages unknown.

The ovipositor of this species is very similar to that of the European *argentella.*[15] However, in that species the hind wings are broad, in *lamina* they are narrow and acuminate.

(15) **Elachista sincera** Braun (Fig. 116.)

1925. *Elachista sincera* Braun, Trans. Am. Ent. Soc., LI, 210. Type ♀, Logan Canyon, near Logan, Utah, altitude 5500 feet [A. F. B. Coll.].

Head and palpi white; antennae white with pale fuscous annulations, darker toward tips. Thorax and fore wings pure white; veins R_4 and R_5 coincident. Hind wings very narrow, acuminate, veins R_s and M_1 very long stalked, wings and cilia white. Legs white, fuscous shading on fore and middle tarsi. Abdomen white.

Alar expanse: 9 mm.

Male unknown.

Female genitalia (fig. 116): bursa copulatrix diagonally placed, spiculate, without signum; ductus bursae narrow in the section nearest bursa and armed with longitudinal rows of minute teeth, once coiled just before entering a very thick-walled section which lies in segments 6 and 7; the lumen of the ductus slightly inflated in segment 7, and armed with a cluster of heavily sclerotized teeth; just before ostium abruptly contracting, ostium opening in a nearly hemispherical spinulate depression in the weakly sclerotized genital plate; lobes of the ovipositor rounded. The ductus seminalis appears to arise from the bursa copulatrix, a character aberrant for the genus.

Known only from the female type, which was captured on the wing in Logan Canyon, Cache County, Utah, in an open Douglas fir and juniper growth at 5500 feet, June 26, 1924.

[15] In Europe two species have been confused under the names *argentella* and *cygnipennella*, one an *Elachista*, the other a *Mendesia*. The genitalia of *Elachista argentella* Cl. (syn. *cygnipennella* Hbn.) are figured by Pierce and Metcalfe (Genitalia of the British Tineina, 1935, Plate XXVIII). The other species, with complete venation and genitalia of the type of *Onceroptila cygnodiella* (Busck) (cf. Pl. VIII, fig. 54) should be known as *Mendesia farinella* Thnbg. (cf. Janmoulle, 1948, Lambillionea, XLVII, pp. 67, 71).

Food plant and early stages unknown.

E. sincera may be recognized by the pure white fore wings, the narrow acuminate hind wings, with the unusually long stalking of veins R_s and M_1. The greatly thickened wall of the posterior two-thirds of the ductus bursae is an unusual character for the genus, and the origin of the ductus seminalis from the bursa is aberrant for the genus. However, *sincera* is best retained in *Elachista* unless discovery of the male shows that a new genus should be erected.

(16) **Elachista parvipulvella** Chambers

1875. *Elachista parvipulvella* Chambers, Canad. Ent., VII, 56. Type (without abdomen), Texas, collection of C. V. Riley, [U. S. N. M., Type No. 499].

1878. *Elachista parvipulvella* Chambers, Bull. U. S. Geol. and Geogr. Surv. of Terr., IV, 96. (A note under *texanella.*)

In a paper entitled "Tineina from Texas," Chambers (1875, Canad. Ent., VII, p. 56) thus briefly characterized this species:

"White; a few ocherous scales scattered over the primaries, especially towards the apex. *Al. ex.* scarcely ¼ inch. Season, May, July, August and September."

A few years later (1878, Bull. U. S. Geol. Surv., IV, p. 96), in comparing *parvipulvella* with *texanella,* he says, "*E. parvipulvella* Cham. has wider wings, is more creamy-white, and is distinctly dusted with brownish-ocherous, and has the outer surface of the palpi brownish."

Of all the supposed types of *E. parvipulvella* examined, only Type 499 (U. S. N. M.) is an *Elachista,* and it alone agrees with Chambers' statement, "outer surface of the palpi brownish"; hence Type No. 499 (U. S. N. M.) must be regarded as the type of *E. parvipulvella* Chambers. This type bears four labels, viz. (1) *Elachista parvipulvella* Cham., with "Texas" written in the lower left hand corner, presumably in Chambers' handwriting, (2) Collection of C. V. Riley, (3) a small blue label with the numeral "1175," some undecipherable pencil marking and also in pencil "1882," (4) red type label U. S. N. M. No. 499.

I herewith give a more detailed description of this type:

Head white, slightly speckled; palpi white with fuscous dusting outwardly. Fore wing white, the scales fuscous-tipped, the white ground color however predominating; at end of fold and at end of cell, more broadly dark-tipped scales form very small and obscurely defined fuscous dots. Hind wings and cilia white.

An examination of the supposed types (4) at the Museum of Comparative Zoology all numbered 1513, and labeled "Texas, Chambers" showed that none of these is an *Elachista;* one is a *Gnorimoschema,* the other three Scythrids, with coloration of the fore wing very similar to that of Type 499 at the United States National Museum, but with hind wings darker than the fore wings, and palpal structure and coloration not in agreement with Chambers' statement (in these supposed types the palpi are dark, with a pale annulus at tip of second segment and near tip of third segment). The venation of the hind wing as seen on a slide of undenuded wings (presumably the right pair from one of these supposed types) at the United States National Museum is that of *Scythris.*

The type is the only representative of the species I have seen.

(17) **Elachista coniophora** new species (Figs. 64, 64a, 119.)

Head whitish, dusted with pale ashy fuscous, palpi whitish, second segment more or less shaded with pale fuscous; antennae pale ashy fuscous, each segment minutely margined at apex with the whitish color. Ground color of the fore wings white, so shaded and dusted with pale fuscous as to obscure the white except in a broad stripe which extends from base along the fold to its middle, and is thence bent upward, paralleling the outer cell margin, and diffuses in the apical third of the wing. From near base, dark brown scales form a dotted line through the white stripe along the fold, and margin its lower side along the outer margin of the cell; occasionally these scales are few in number and the dotted line not clearly formed. Brown scales are scattered in the apical third of the wing and are usually concentrated at apex, forming a dusted brownish patch. The dark line in the cilia extends from costa around apex in a sharp curve, and fades out before tornus. Hind wings pale ashy fuscous, dorsal cilia whitish toward the base of the wing. Fore and middle legs densely dusted with the pale ashy scales, hind legs nearly pure white. Abdomen shaded with pale fuscous above, white beneath.

Alar expanse: 9.5 to 10 mm.

Male genitalia (figs. 64, 64a): uncus cleft to suture, lobes large, a few marginal setae; gnathos elongate; sacculus process rather small, with rounded swollen apex, setae arranged in two groups, one half-way from base, the other apical; anellus elongate, the lobes acutely rounded, strongly sclerotized and bearing a few marginal setae; vinculum broadly rounded, almost truncate; aedeagus a short wide cylinder, somewhat swollen at base, no cornutus.

Female genitalia (fig. 119): bursa copulatrix elongate, gradually narrowing to the short ductus bursae, surface sparsely and minutely spiculate, no signum; ductus bursae with a narrow sclerotized band preceding the abruptly bowl-shaped widening before ostium; ovipositor lobes small and rounded.

Type.— ♂, San Diego, California, April (Ricksecker), [U. S. N. M., Type No. 34827].

Allotype.— ♀, Colfax, Placer County, California, May 1–10 (A. H. Vachell), [U. S. N. M., Type No. 34827].

Paratypes.—5 ♂, same data as the type [U. S. N. M.].

Food plant and early stages unknown.

The two localities, although about a thousand miles apart, are in essentially the same vegetation region.

This species is easily distinguished from all other described American species of this section of the genus by the broad white undusted stripe through the middle of the wing, marked with a row of dark scales. In genitalia, it is equally distinct.

(18) **Elachista hiberna** new species (Figs. 14, 22, 22a, 25, 34, 73, 74.)

Head yellowish white to pale gray, becoming darker posteriorly; face yellowish white; palpi white above and inwardly, second segment, except tip, dark fuscous outwardly, third segment with a little fuscous shading outwardly near tip. Antennae blackish fuscous in the basal half, paler in the outer half, with annulations narrow and scarcely paler in the basal half, contrasting in the outer half; antennal pecten of 10 or 11 long and short hairs. Thorax and fore wings dark blackish brown, slightly irrorate; R_4 and R_5 coincident (fig. 14); a median white fascia, usually a little wider on dorsum, a row of black scales projecting into the cilia at apex and along termen; tips of cilia white opposite apex and in the female half-way along termen, gray toward tornus. Hind wings brownish gray, darker in the male. Legs dark blackish brown, extreme tips of segments whitish, posterior tibiae white inwardly. Abdomen dark fuscous above, paler beneath.

Alar expanse: 9 to 12 mm., of type, 10.5 mm.

Male genitalia (fig. 74): uncus lobes separated, a few setae apically; gnathos ovoid; harpe broad, costa excavated, basal process of sacculus a flattened broad flap, apex produced; anellus deeply cleft, lobes narrow, parallel-sided; vinculum short, sclerotized band broad, not produced; aedeagus broad at base, curving and tapering to narrow apex, no cornutus.

Female genitalia (fig. 73): ostium small, opening at the anterior margin of the genital plate; inception of ductus seminalis near ostium; ductus bursae membranous throughout, long, but *in situ* with a couple of coils; bursa copulatrix in segments 4 and 5, membrane smooth, signa two, placed longitudinally on opposite sides of the bursa, each a finely dentate elongate spindle-shaped patch.

Type.— ♀, Shepherd Mountain, Pike County, Ohio, under rearing record B.1401, date of emergence June 2, 1940 [A. F. B. Coll.].

Allotype.—♂, Cascapedia, Quebec, 21–VI–1933 (W. J. Brown), [C. N. Coll., Type No. 5738].

Paratypes.—1 ♂, Cascapedia, Quebec, 20–VI–1933 (W. J. Brown), [C. N. Coll.]; 20 ♀, Shepherd Mountain, Pike County, Ohio, dates of emergence from May 26 to June 4, 1940; 5 ♀, Rocky Fork, Scioto County, Ohio, dates of emergence, June 3 to June 21, 1940, and May 12–13, 1946; 1 ♀, Cedar Falls, Adams County, Ohio, date of emergence, May 14, 1939, all under rearing record B.1401 [A. F. B. Coll.]; 1 ♂, 1 ♀ (without abdomens), "Wyo. Co., Pa., 2300′, VI.17.06, W. D. Kearfott," [U. S. N. M.].

A female of the reared series is chosen as the type, since all the data on the life history were secured from this series, in which unfortunately there are no males.

The two paratypes from Pennsylvania although in poor condition are included in the type series because of the intermediate locality.

In addition to the localities in which moths were collected or reared, I have observed mining larvae in the Red River Gorge, Menifee County, Kentucky.

The following description of the life history is based on observations made in Ohio; the larva may have other food plants elsewhere.

Soon after emergence of the moths, the eggs (fig. 25) are deposited on the underside of the stem leaves of the grass, *Diarrhena americana* Beauv., often in pairs, one each side of the midrib. The larva on hatching makes a short thread-like mine about one-half inch in length; then follows a long resting period during which this early mine turns brown. Feeding is resumed about October 1, and the larvae become full grown late in November or early in December. The mine usually extends toward the tip of the leaf, but sometimes doubles back on itself; it is usually confined to one-half of the leaf; its length varies from 6 to 8 inches, depending on the breadth of the leaf and consequent breadth of the mine. From the place where the larva is feeding at any time, a faintly outlined tubular runway, lightly silk-lined, extends back to the early part of the mine, where the frass is packed. The parenchyma is consumed, and the mine is about equally visible from either surface. The larva hibernates near the beginning of the tubular runway, which is here more densely silk-lined. Pupation takes place outside the mine in

early spring (March). The pupa is attached by anal end and silken girdle, with a few lose strands of silk above it.

The nearly full grown larva (figs. 22, 22a) is of a dull olive green color, prothoracic shield yellowish brown with a brown broadly anchor-shaped mark, divided by a paler line; setae minute. Cuticle of the pupa (fig. 34) shining.

This is the only known American species marked only with a median fascia. The great variation in wing expanse doubtless reflects the condition of the leaves of the food plant during the late fall when drought or an early heavy freeze may have dried the tissues.

(19) **Elachista patriodoxa** Meyrick (Figs. 13, 75, 75a, 76, 76a.)

1932. *Elachista patriodoxa* Meyrick, Exot. Microlep., IV, 216.

Type ♀, Muskoka, Ontario, [British Museum].

Head posteriorly dark gray, shading to creamy white on the face; palpi creamy white, second segment fuscous outwardly, third slightly shaded with fuscous outwardly; antennae dark fuscous, blackish toward base. Thorax and fore wings dark fuscous, slightly purplish tinged, the purple tinge more apparent basad of the fascia; at one-third, an irregular-edged, shining white fascia; an erect, narrowly triangular white spot at tornus and a similar spot on costa slightly beyond it; both of these spots are larger in the female. Cilia dark purplish gray, tips white opposite apex; marginal row of scales forming a contrasting line through them, best defined in the female. Hind wings dark brownish gray, a little paler in the female. Legs dark fuscous, tips of segments whitish, posterior tibiae white inwardly except for a narrow darker band near apex. Abdomen dark gray, whitish ocherous beneath.

Alar expanse: 9 to 10 mm.

Male genitalia (figs. 75, 75a): markedly different from all other American species; lobes of uncus with apices converging and strongly sclerotized; ventral plate of anellus prolonged into a pair of long sclerotized rods, anellus dorsolaterally with a low setose papilla; aedeagus stout, cylindrical, cornutus consisting of a large heavy posteriorly directed spine and a small anteriorly directed spine arising from a sclerotized base.

Female genitalia (figs. 76, 76a, from type[16]): ostium toward the posterior margin of the eighth segment; ductus bursae short, sclerotized in the eighth segment and abruptly constricted at the anterior margin of the eighth segment, with lateral wing-like, strongly sclerotized margins before ostium and with the edge at ostium turned inwardly (*i.e.* dorsad, then mesad); anterior to the constriction, ductus bursae abruptly widening, with inception of ductus seminalis

[16] I am indebted to Mr. J. F. Gates Clarke for the figures of the female genitalia, drawn from a slide made from the type in the British Museum.

in a slight sac-like production; from thence to the bursa copulatrix roughened by minute nodules; bursa copulatrix elongate oval, extending to about the middle of the third segment, membrane smooth, signa two, each a narrow acuminate marginally dentate plate.

Specimens examined: 1 ♂, 1 ♀ without abdomen.

ONTARIO: Trenton, 1 ♂, 15–VII–12 (Evans), [C. N. Coll.].

NEW HAMPSHIRE: Hampton, 1 ♀ (without abdomen), X–27–1908 (S. A. Shaw), [U. S. N. M.].

Food plant and early stages unknown.

Mr. J. F. Gates Clarke has kindly examined the type of *patriodoxa* (a female, not a male as stated by Meyrick) and has furnished me with an accurate sketch of the venation. In the fore wing of the type (fig. 13) R_4 and R_5 are coincident, $M_3 + Cu_{1a}$ obsolete, represented only by a stub; the cell of the hind wing is open, but M_3 arches up toward the radial stem as in all species of the section. The male from Trenton, Ontario, in the Canadian National Collection agrees exactly in venation with this female type, except that $M_3 + Cu_{1a}$ is present as a distinct vein. In the female from New Hampshire, the cell of the hind wing is closed.

In *patriodoxa,* the position of the fascia is somewhat basad of that in similarly marked species of Section II. Meyrick allies *patriodoxa* to *unifasciella* Chambers, presumably on the basis of different wing color before and behind the fascia. *Unifasciella* belongs in Section II of the genus.

Section II

(20) **Elachista irrorata** Braun (Figs. 19, 37, 37a, 77, 77a, 117, 117a.)

1920. *Elachista irrorata* Braun, Ohio Journ. Sci., xx, 171. Type ♀, near Cincinnati, Ohio [A. F. B. Coll.].

1921. *Elachista irrorata* Braun, Ohio Journ. Sci., xxi, 209.

1923. *Aphelosetia irrorata* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 223.

1932. *Elachista philopatris* Meyrick, Exot. Microlep., iv (Pt. 7), 216. Type ♀, Muskoka, Ontario [British Museum]. [New synonymy.]

Head dark gray, densely speckled with black (easily abraded, then appearing as if shining gray); palpi blackish below, in the male whitish above, or sometimes gray above and scarcely paler than below, with the third segment swollen and abruptly acute; in the female, paler above than in the male, with third segment scarcely swollen. Antennae black, paler above, slightly thickened in male,

with segments short. Thorax dark gray, black speckled. Fore wing rather broad, veins M_2 and $M_3 + Cu_{1a}$ connate or short stalked (fig. 19); dark gray, so densely speckled with black that the general aspect is nearly black. Just beyond one-third, a narrow indented or angulated white fascia, distinct in the female, but in the male often reduced to a few scattered white scales; at two-thirds, a triangular white costal spot, its apex nearly touching a minute white discal spot which is often absent; opposite it, a narrower white dorsal spot; both spots often greatly reduced in the male. Cilia gray, with the marginal row of black scales projecting into them in a curve so broad as to give the wing a truncated appearance. Hind wing broad, with dorsal margin slightly convex before tip; forking of R_s indicated; gray, densely irrorated with black. Legs blackish with tips of segments and a band near base of hind tibiae white. Abdomen dark gray above, becoming whitish beneath.

Alar expanse: 8.2 to 11 mm.

Male genitalia (figs. 77, 77a) characterized by the short tegumen and short harpes, the latter not exceeding the uncus; broad, laterally flattened sacculus processes; truncate lobes of the anellus; the strongly sclerotized, thickened and bifid tip of aedeagus, and absence of cornutus.

Female genitalia (figs. 117, 117a): dilated portion of ductus bursae before ostium broadly cup-shaped and flaring; ostium spinulate, the spinules shorter than their distance apart; ductus bursae comparatively short, sclerotized to middle of segment 6, then abruptly widening and minutely spiculate at inception of ductus seminalis, thence gradually widening to the densely spiculate indistinctly bilobed bursa copulatrix lying in segments 3, 4, and part of 5; signum an angled, weakly sclerotized dentate crescent.

Specimens examined: 13 ♂, 10 ♀.

Ohio: Hazelwood (near Cincinnati), ♀ type, July 22, 1919 [A. F. B. Coll.]; Cincinnati, 8 ♂, 8 ♀, under rearing record B.1037, with dates of emergence from May 19 to June 10, 1920 [A. F. B. Coll. and A. N. S. P.].

Pennsylvania: Philadelphia: 1 ♀ (F. Haimbach), [A. N. S. P.].

Ontario: Ottawa, 5 ♂, June 20, 25, 28, July 4, 1932; July 14, 1934 (C. H. Young), [C. N. Coll.].

The larva commonly mines leaves of *Glyceria striata* (Lam.) Hitchc. (a grass of wet places) in April and May. The mine of the type specimen occurred on *Agrostis perennans* (Walt.) Tuckerm. The narrow indistinct pale yellowish green mine begins low down on the leaf sheath (where the larva lies concealed during the day) and extends toward the tip of the leaf; a short detached mine, untenanted during the day, may be made near the tip of the leaf. Larva yellow when young, glaucous above when full grown. Deserted mines, apparently of this species, were observed on *Glyceria* at Sherburne Pass, Vermont, June 26, 1946.

The pupa (figs. 37, 37a) is attached near the base of the leaf with head directed toward the stem; the cuticle is dull, body much flattened, lateral ridges of abdomen projecting, tubercles on the mesothorax less prominent than those of its allies of which the life history is known.

The connate or short stalked veins M_2 and $M_3 + Cu_{1a}$ of the fore wing (fig. 19), a character found in no other species of the genus, the broad curve of the scales around apex, the shape of the hind wing and the bifid sclerotized tip of aedeagus with absence of cornutus separate *irrorata* from all related species. This species alone of all examined has the thickened bifid tip of aedeagus. *E. irrorata, E. fuliginea, E. oxytypa, E. leucofrons* and *E. albicapitella* agree in the truncate lobes of the anellus (cf. figs. 77, 79, 84, 86) and in the female, in the indistinctly bilobed spiculate bursa.

The "small discal spot" beyond the tip of the costal spot, mentioned by Meyrick in the description of *philopatris,* is present in a goodly proportion of the specimens. An examination of the wing venation of the female type (not male, as stated by Meyrick) by Mr. J. F. Gates Clarke confirms the synonymy of *philopatris* with *irrorata.*

The great amount of specific variation, especially between the sexes, is a noteworthy character of the species.

A pair of specimens, Skyline Ridge, Mt. Baker, State of Washington (J. F. Gates Clarke) approach very closely to *irrorata* in genitalic characters, but M_2 and $M_3 + Cu_{1a}$ are separate in the fore wing. The specimens are in too poor condition for description.

(21) **Elachista fuliginea** new species (Figs. 79, 79a, 122.)

Head brownish black, darkest behind, face faintly lustrous, brownish; second segment of palpi black in male, grayish brown in female, whitish above and inwardly, third segment mostly whitish with extreme tip black, not thickened. Antennae slender, black with faint paler annulations in the female. Thorax black. Fore wing before the fascia sooty black with a faint purple tinge, very slightly irrorated beyond fascia which lies just beyond one-third and is lustrous white; just beyond two-thirds a rather broad lustrous white costal spot extends to the middle of the wing, a little nearer base, a smaller dorsal spot; both may be obliquely produced joining in the middle of the wing to form an angulated fascia. A row of black-tipped scales around apex, with a sprinkling of dark scales in cilia below apex; cilia dark gray, paler opposite apex. Underside of fore wing blackish. Hind wing acuminate with the dorsal margin slightly concave before apex, dark gray, irrorated with black. Legs dark gray, hind

tibiae with an oblique white band before middle and tip white, inwardly whitish; tarsi white-tipped. Abdomen dark gray above, paler beneath posteriorly.

Alar expanse: 9 to 10 mm. (♂); 10 mm. (♀).

Male genitalia (figs. 79, 79a): harpes scarcely exceeding the uncus, sacculus process rather broad, laterally flattened; anellus lobes truncate; aedeagus not thickened at tip, emarginate; cornuti, a blunt tooth-like spine and a slender acute spine beyond it.

Female genitalia (fig. 122): very similar to those of *irrorata,* except for the greater length of the sclerotized portion of ductus bursae, with dilated part before ostium deeper and ostium narrower, with spinules longer than their distance apart; signum as in *irrorata.*

Type.—♂, Martha's Vineyard, Massachusetts, VIII–7 (F. M. Jones), [A. N. S. P., Type No. 7812].

Allotype.—♀, Ottawa, Ontario, July 10, 1934 (C. H. Young), [C. N. Coll., Type No. 5739]. The one female is associated with the males on the basis of identical coloration and scaling, identical venation and shape of hind wing.

Paratypes.—14 ♂, Martha's Vineyard, Massachusetts, June 29 to September 4 (F. M. Jones), [10 paratypes, A. N. S. P., 2 paratypes, F. M. Jones Coll., 2 paratypes, A. F. B. Coll.]; 1 ♂, Caldwell, New Jersey, July 8, 1900 (W. D. Kearfott), [M. C. Z.].

In addition to the type material, one specimen in poor condition, Caldwell, N. J., July 8, 1900 (W. D. Kearfott), [U. S. N. M.].

Food plant and early stages unknown.

This species is very close to *E. irrorata* and worn specimens of the two species are superficially scarcely distinguishable. However, in *E. fuliginea,* veins M_2 and $M_3 + Cu_{1a}$ of the fore wing are widely separate, R_3 connate with the stalk of R_4, R_5 and M_1, and the hind wing is narrower and acuminate. The two species are easily distinguished in the male by characters of the aedeagus, and less easily in the female by differences in the ductus bursae and ostium.

(22) **Elachista oxytypa** new species (Figs. 80, 80a, 118.)

Head pale brownish gray, the scales tipped with dark brown; palpi pale gray, outer side of second segment darker, silvery above, third segment mostly pale, with tip blackish. Antennae gray, paler in the female. Thorax gray, tegulae pale in the female. Fore wings gray, the scales pale at base, unevenly tipped with dark brown, resulting in an irregularly irrorated dark grayish brown appearance; near middle of dorsum, a somewhat oblique grayish white bar extends to the upper margin of the cell in the male type; in the male para-

type, this mark is reduced in size and obsolete beyond the fold; in the allotype, female, the corresponding mark is a creamy white fascia oblique on dorsum, and curving toward base as it approaches costa. At tornus, a small triangular spot, grayish white in male, creamy white in female; farther from base on costa, a similar but larger spot. The scales at apex form a point, and the row of scales projecting into the cilia extends around apex in a sharp curve. Costal cilia gray, cilia below apex whitish at base in male, whitish in female except at tips. Underside of wings densely irrorated with black. Hind wings broad, tapering abruptly, gray, densely irrorated with dark brown; paler in female. Legs dark brownish gray, with the usual pale bands and tips of segments not sharply contrasting. Abdomen dark brownish gray above and below.

Alar expanse: 10.5 to 11 mm.

Male genitalia very similar to those of *irrorata*, but sacculus processes more slender and harpe narrower (fig. 80), and tip of aedeagus unmodified; two cornuti, a strong short, acute, broad-based spine, and a similar minute spine beyond it (fig. 80a).

Female genitalia (fig. 118): dilated portion of ductus bursae deeply cup-shaped, ductus bursae sclerotized only to anterior margin of segment 7; signum as in *irrorata*.

Type.— ♂, Bradore Bay, Quebec, 8,VIII,1930 (W. J. Brown), [C. N. Coll., Type No. 5740].

Allotype.— ♀, Bradore Bay, Quebec, 8,VIII,1930 (W. J. Brown), [C. N. Coll., Type No. 5740].

Paratype.— ♂, same data as the type [C. N. Coll., No. 5740].

Food plant and early stages unknown.

Superficially this species may be separated from its allies by its grayish appearance, with weakly contrasting pale marks in the male, by the point of scales at apex, and the sharp curve of scales around apex with contrasting costal and terminal cilia. Veins M_2 and $M_3 + Cu_{1a}$ of the fore wing are separate. On genitalic characters, the cornuti of the male, and shape and length of the sclerotized portion of the ductus bursae distinguish it.

(23) **Elachista pusilla** Frey and Boll

1876. *Elachista pusilla* Frey and Boll, Stett. ent. Zeit., XXXVII, 215. Type locality, Texas (Dallas ?). [Location of type unknown.]

The type of this species could not be located; it is not in the British Museum, where Frey's material is supposed to be. It must remain at present an unrecognized species.

The following is a translation embodying the essential points of the description:

Head dark blackish gray; face paler, leaden gray and lustrous metallic like the similarly colored palpi; legs pale whitish gray, the tibiae and tarsi of the metathoracic pair spotted and annulate with black. Thorax, fore wings and abdomen above blackish gray; abdomen paler beneath. At three-sevenths the length of the fore wings, a double, crescent-shaped, outwardly convex transverse white band.[17] At three-fourths the wing length, a similar but moderately broad transverse band. Toward apex, darker, blackish scales form an indistinct spot. Cilia dark gray; at apex not noticeably different. Hind wings and cilia gray.

Frey compared *E. pusilla* with the European *E. exactella* H.-S.; of the size of the smallest specimen of that species, but stouter and broader-winged.

(24) **Elachista unifasciella** Chambers

1875. *Elachista unifasciella* Chambers, Canad. Ent., VII, 147. Type locality, "Canada."

1923. *Aphelosetia unifasciella* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 223.

No type of this species is in existence, either in the Museum of Comparative Zoology or in the United States National Museum, where the types from the Belanger Collection, obtained from Laval University, Quebec, are now located, and I have seen no specimen which can be thus identified.

I quote Chambers' description and his remarks:

"Antennae brownish purple; palpi white. Head, thorax and fore wings brownish purple, in some lights reddish purple. There is an oblique white fascia just before the middle of the fore wings, which is a little nearer the base on the costal than on the dorsal margin, and the color of the wing is much deeper behind the wing [as printed] than before it. There is a small white spot just before the dorsal ciliae, and a little behind it is a narrow costal white streak, which passes obliquely backwards nearly across the wing. The legs and tarsi are marked with brownish purple and yellowish white bands and spots. *Al. ex.* ¼ inch. The white markings on the wings are metallic in some lights. I think it is not likely to be mistaken for any known species."

[17] The original description reads "Hier steht in drei Siebenteln der Flügellänge ein aus zwei (mit nach hinten gerichteter Convexität geformtes) doppelt halbmondformiges weisses Querband." As I interpret this, the "double transverse band" is formed by a pair of opposite spots, joining in the middle of the wing.

Chambers' description of the legs as banded would indicate that the species is correctly placed in Section II of the genus, and is not allied to *patriodoxa* Meyrick which belongs in Section I.

(25) **Elachista maculoscella** (Clemens)

1860. *Cosmiotes maculoscella* Clemens, Proc. Acad. Nat. Sci. Phila., p. 9. Type ♂, Pennsylvania (Easton ?). [A. N. S. P., Type No. 7396.]

1872. *Cosmiotes maculoscella* Clemens, in Stainton, Tineina of No. Amer., p. 98.

1878. *Elachista maculoseella* Chambers, Bull. U. S. Geol. and Geogr. Surv. of Terr., IV, 139.

1903. *Cosmiotes maculoscella* Busck, Proc. Ent. Soc. Wash., V, 197.

1923. *Aphelosetia maculosella* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 223.

I quote Clemens' statement of the venation, together with his description of the species:

"Median vein of hind-wing three-branched. Apical vein forked on the costa, with a nervulet to the inner margin.

"Labial palpi dull yellowish. Head dark brownish. Antennae fuscous. Fore-wings shining silvery grayish, suffused with dark golden-brown, with a rather obscure silvery band in the middle of the wing and a silvery spot on the costa just before the tip. The extreme apical portion of the wing is blackish-brown; cilia grayish-brown. Hind-wings grayish, dusted with dark brown; cilia grayish brown."

Alar expanse: 7 mm.

The type is considerably worn, with the left pair of wings missing, but the ground color is in general dark brown, with bronzy tints, appreciably darkening in the apical part of the wing; the fascia is before, rather than in the middle of the wing; slightly basad of the silvery costal spot, a few silvery scales are present on the dorsal margin in the position of the usual dorsal spot.

Examination of the venation of the type shows that veins Cu_{1b}, Cu_{1a} and M_3 are present in the hind wing, with the cell open between M_3 and $R_s + M_1$. This, together with the general type of markings indicates its affinity with the *irrorata* group.

I have seen no other specimens which can be identified as this species.

(26) **Elachista excelsicola** new species (Figs. 82, 82a, 123, 123a.)

Face pale yellowish gray, vertex a little darker; palpi whitish, shaded beneath and outwardly with dark gray; antennae gray, paler toward tips. Thorax pale gray, with darker-tipped scales; tips of tegulae and mesothorax whitish. Scales of the fore wing dirty creamy white at their bases, unevenly tipped with gray, so that the resulting general color is a pale gray; the wing becomes paler from base to apex. Just beyond basal third, an obscure pale fascia dusted with the dark-tipped scales; at two-thirds a whitish costal and a nearly opposite slightly larger dorsal spot are more clearly defined than the fascia. Costal cilia pale gray, cilia at apex and for about half of termen whitish, toward tornus pale gray; the scales forming the line through the cilia creamy white, at apex minutely dark-tipped, below apex very narrowly dark-tipped, so that the extreme apex of the wing is predominantly creamy white. Hind wings broad, abruptly tapering, pale gray, cilia creamy white at bases shading to pale gray, but mostly creamy white around apex. Legs pale gray, pale bands of posterior tibiae scarcely contrasting.

Alar expanse: 10 to 10.5 mm.

Male genitalia (figs. 82, 82a) characteristic; sacculus processes club-shaped; lobes of anellus elongate, each culminating in an acute posterior projection at the margin of the cleft, laterally wrinkled; vinculum produced, gradually narrowing to the acute anterior projection; aedeagus slender, cornutus a slender curved spine.

Female genitalia (figs. 123, 123a): genital plate weakly sclerotized, but with an acute median projection into the clear membrane at ostium; ostium broad, ductus bursae gradually narrowing from ostium and sclerotized nearly to the anterior margin of segment 6, where at the inception of the ductus seminalis it bears four oval sclerotized dentate knobs (fig. 123a), thence greatly widening to the bilobed spiculate bursa copulatrix; signum an elongate narrow dentate crescent.

Type.— ♂, Mt. Washington, New Hampshire, 17.VII.1929 (J. McDunnough), [C. N. Coll., Type No. 5741].

Allotype.— ♀, same data as the type [C. N. Coll., Type No. 5741].

Food plant and early stages unknown.

In general appearance, this species comes closest to *oxytypa,* but in *excelsicola* the fascia is obscure in the female as well as in the male. In genitalic characters it is abundantly distinct from all other known species.

(27) **Elachista stramineola** Braun (Figs. 83, 127.)

1921. *Elachista stramineola* Braun, Proc. Acad. Nat. Sci. Phila., LXXIII, p. 16. Type ♀, Glacier National Park, Montana [A. F. B. Coll.].

Head varying from pale gray to dark gray, face rarely whitish; palpi whitish above and sometimes inwardly in female, second segment blackish outwardly (and in male inwardly), except at extreme tip, third segment blackish outwardly and in male with some dark shading inwardly, base and extreme tip white, slightly thickened in the male. Antennae in the female gray with narrow paler annulations, in the male thickened, blackish, without paler annulations. Thorax gray, tips of tegulae white, a pair of white dots, often confluent, at tip of mesothorax. Fore wings dark gray, more or less irrorated; at base of dorsum an elongate whitish spot, not reaching costa and occasionally produced along dorsum to the fascia, is more or less dusted with gray and in the male is usually obliterated by the dense dusting; just beyond one-third the wing length an irregular white fascia, often angulated by indentation with ground color on its basal side and nearer base on costa, broad in female, but in the male often reduced to scattered whitish scales; at two-thirds a rather large white spot on costa, and nearer base a similar, but usually smaller, white tornal spot; both spots usually greatly reduced in the male. Scales along termen yellowish at bases; the black-tipped scales projecting into the cilia palest immediately before their dark tips. Cilia gray. Hind wings and cilia pale fuscous. Legs fuscous, with the usual pale bands. Abdomen dark gray above, paler beneath posteriorly.

Alar expanse: 9 to 11.5 mm.

Male genitalia (fig. 83): harpes exceeding the uncus lobes; sacculus processes club-shaped, with setae borne inwardly as well as at the apex; anellus lobes curving to the inwardly directed pointed tips, wrinkled laterally; vinculum with an abrupt blunt anterior projection; cornutus a single sinuate spine placed almost at tip of aedeagus.

Female genitalia (fig. 127): genital plate sclerotized and produced midventrally, appearing to indent the margin of segment 7, the produced lateral margins parallel; ostium at anterior margin of genital plate, spinulate; dilated portion of ductus bursae before ostium deeply cup-shaped; ductus bursae shortly sclerotized, with inception of ductus seminalis in segment 7; bursa copulatrix bilobed, spiculate, signum a dentate sclerotized band.

Specimens examined: 8 ♂, 10 ♀.

MONTANA: Glacier National Park, ♀ type, July 29, 1920 [A. F. B. Coll.].

WASHINGTON: Bellingham, 1 ♂, V–24–23 (J. F. Clarke).

BRITISH COLUMBIA: Victoria, 2 ♂, 2 ♀, 20–V–21, 20–V–22, 23–V–22 (E. H. Blackmore), [A. F. B. Coll.]; 2 ♂, 14–7–1923; 1 ♂, 20–May–1922, 6 ♀, May 11 to June 18, 1922 and 1923 (W. R. Carter), [U. S. N. M.]; 1 ♀, 3–V–21 (E. H. Blackmore), [U. S. N. M.].

CALIFORNIA: Yosemite National Park, 2 ♂, VII–26–15 [A. F. B. Coll.].

Food plant and early stages unknown.

This species appears to be the commonest species of the Pacific Northwest, ranging south to California in the Sierras, and eastward to Montana.

Females of the British Columbia series agree exactly in genitalic characters with the type; males collected at approximately the same dates are associated with them. Males with obsolete markings are superficially scarcely distinguishable from male *irrorata;* the whitish tips of tegulae and mesothorax are constant and reliable separation characters in even the darkest specimens of *stramineola.* In *stramineola,* the costal spot is beyond the tornal spot. The whitish elongate spot along base of dorsum characterizes the female. Veins M_2 and $M_3 + Cu_{1a}$ of the fore wing are separate in *stramineola.*

In genitalia, the shape of the anellus lobes and the single sinuate cornutus of the male, and the shape of the produced genital plate of the female with its parallel margins characterize this species.

(28) **Elachista leucofrons** Braun (Figs. 17, 36, 84, 126, 126a.)

1920. *Elachista leucofrons* Braun, Ohio Journ. Sci., xx, 170. Type ♂, Cincinnati, Ohio [A. F. B. Coll.].

1921. *Elachista leucofrons* Braun, Ohio Journ. Sci., xxi, 209.

1923. *Aphelosetia leucofrons* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 222.

Head blackish, slightly irrorated, with a creamy white patch across the face below base of antennae, sometimes covering the whole face below the antennae; palpi black below and at extreme apex, white above, the white completely encircling the base of the third segment and tip of the second; antennae gray, with pale annulations which become white and more conspicuous toward tip in female. Thorax blackish, with tips of tegulae white; fore wings blackish, slightly irrorated, the irroration sometimes forming faint whitish lines of which two, one below and one above the fold and parallel with it, are most often discernible. Wing from extreme base of costa across to dorsum narrowly white; an irregular narrow white fascia just beyond one-third, oblique in its costal half, nearly perpendicular in its dorsal half; an erect narrow white spot at tornus, and nearer apex, a similar costal spot, sometimes nearly obsolete; a row of black-tipped scales at base of the grayish black cilia. Hind wings and cilia dark blackish brown. Legs except femora blackish, with tips of all segments and basal half of hind tibiae, whitish. Abdomen blackish brown above, entire body silvery beneath, with a yellowish tinge.

Alar expanse: 9 to 10 mm.

Male genitalia (fig. 84): gnathos rounded; harpes exceeding the uncus, sacculus processes more slender than in *irrorata;* anellus lobes truncate; vinculum broadly rounded and bluntly produced anteriorly; vesica armed with a heavy blunt spine and a cluster of one longer and several shorter sharp spines.

Female genitalia (figs. 126, 126a): dilated portion of ductus bursae before ostium tub-shaped, preceded by a weakly sclerotized band, which in turn is preceded by a more strongly sclerotized segment, extending anteriorly to the middle of segment 7. At the inception of the ductus seminalis in segment 7, the ductus bursae bears two blunt teeth. Bursa copulatrix bilobed, and densely spiculate; signum a strongly sclerotized rather broad dentate band.

Specimens examined: 22 ♂, 13 ♀.

Ohio: Cincinnati, ♂ type, imago, May 12, 1919; 4 ♂ paratypes [A. F. B. Coll.], 1 ♂ paratype [A. N. S. P.], under rearing record B.1002, with dates of emergence from May 3 to May 9, 1919; 12 ♂, 7 ♀, under rearing record B.1031, with dates of emergence from May 19 to May 27, 1920 [A. F. B. Coll.]; 1 ♀, same data [A. N. S. P.]; 1 ♂, "on Elymus," imago, V.5; 2 ♂, 2 ♀, under rearing record B.2033, imagoes from May 3 to May 11, 1943; one ♂ flown specimen, May 23, 1903 [A. F. B. Coll.].

North Carolina: Black Mts., 1 ♀ without abdomen, VI, 17 [U. S. N. M.].

Colorado: Alpine Lodge, Sangre de Cristo Mts., altitude 8800 feet, 1 ♀ without abdomen, VII–16–1934 [A. F. B. Coll.].

New Mexico: Pecos Nat'l For., Alt. 10,000′, 1 ♀, Aug. 24, 1916 (C. Heinrich), [U. S. N. M.].

In the New Mexico specimen the extent of white is increased, with confluence of the pair of spots at two-thirds the wing length, but the genitalia indicate its position here.

The larvae mine leaves of wild rye, *Elymus canadensis* L. and *E. virginicus* L., and less commonly leaves of *Hystrix*. The large whitish mine on *Elymus* starts near the tip of the leaf, extending downward and broadening to the width of the leaf; it lies just beneath the upper epidermis, and the tissue adjacent to the lower epidermis is not eaten, so that the under surface of the leaf remains green. The larva is pale grayish or greenish, with a narrow mid-dorsal and broad lateral lines whitish; prothoracic shield marked posteriorly by a transverse brownish mark, curving forward at each end.

The pupa (fig. 36) is not enclosed in a cocoon but lies close against the leaf, attached by anal end and median silken girdle; dull yellowish gray, elongate, with prominent dorsal and lateral ridges, mesothorax with low rounded tubercles and characteristic sculpture, small tubercles on front of head.

The species is apparently single-brooded. Mines were collected in the latter part of March and early April, and it is probable that the larvae had begun to mine during the preceding autumn.

The species is separated from *albicapitella* (its nearest ally) by the peculiar markings of the palpi, the creamy white face, with absence of white on the crown, and the duller white wing markings.

(29) **Elachista albicapitella** Engel (Figs. 7, 21, 38, 86, 86a, 124, 124a.)

1907. *Elachista albicapitella* Engel, Ent. News, XVIII, 277. Type ♂, Pittsburgh, Pennsylvania [U. S. N. M.].

1920. *Elachista albicapitella* Braun, Ohio Journ. Sci., XX, 170.

1923. *Aphelosetia albicapitella* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 222.

Head silvery white; palpi silvery, second segment gray outwardly and beneath; antennae dark blackish brown, paler and gray toward tips, especially in female. Collar, thorax and fore wing deep dark brown with faint purplish reflections; tegulae, tip of mesothorax and base of fore wing from base of costa across to dorsum silvery white. Just beyond one-third the wing length, a slightly outwardly curved silvery white fascia from costa to dorsum; just beyond two-thirds, an outwardly oblique silvery spot to the middle of the wing, broadest in the female; nearer base, a similar but less oblique dorsal spot. Cilia dark gray, paler opposite apex in the female; a row of dark scales around apex at base of cilia. Hind wings and cilia dark brownish fuscous. Legs dark brown, with spurs, a band near base of hind tibiae, and tips of tibiae and tarsal segments whitish. Abdomen dark brown above, paler beneath posteriorly.

Alar expanse: 8 to 9 mm.

Male genitalia (figs. 86, 86a): lobes of uncus very widely separated; gnathos rounded; harpes exceeding the uncus, sacculus processes rather slender; anellus lobes truncate; vinculum elongate, anteriorly produced; aedeagus slender, vesica armed with a single sharp spine and two unequal blunt spines.

Female genitalia (figs. 124, 124a): dilated portion of ductus bursae before ostium a truncated cone, this preceded by a weakly sclerotized band, which is in turn preceded by a short more strongly sclerotized section; ductus bursae widening in segment 7, and at inception of ductus seminalis bearing three blunt teeth; bursa copulatrix bilobed, densely spiculate, signum a broad dentate sclerotized band.

Specimens examined: 40, ♂, ♀.

PENNSYLVANIA: Pittsburgh, ♂ type, VI.1.06 (Henry Engel), [U. S. N. M.]: New Brighton (Merrick), Oak Station, Allegheny Co., June 4, 1908 (F. Marloff), 9 specimens [U. S. N. M.]; Oak Station, Allegheny Co., 2 ♂, June 17, June 23, 1909 [A. F. B. Coll.]; Hazelton, 1 specimen, 6–30–99 (W. G. Dietz), [M. C. Z.].

OHIO: Cincinnati, 6 ♂, 5 ♀, under rearing record B.1001, with dates of emergence from May 3 to May 6, 1919 [A. F. B. Coll. and A. N. S. P.]; 3 ♀, under rearing record B.2093, with dates of emergence February 8, 12 and 21,

1944 [A. F. B. Coll.]; 6 ♂, 5 ♀, flying, May 20 to June 12 [A. F. B. Coll.]; Clermont County, 1 ♀, June 6, 1919 [A. F. B. Coll.].

Nova Scotia: Baddeck, 1 ♀, 22–VI–1936 (J. McDunnough), [C. N. Coll.].

The larvae mine the overwintering leaves near the bases of the stems of tufts of *Poa sylvestris* A. Gray. In a mild autumn, they may be found nearly full-fed at the end of November; such larvae under rearing conditions pupate in December and produce imagoes in February. More generally however, they are not full grown until the latter half of March. The dates of emergence vary greatly, depending on the season.

The larva makes several mines, with the parenchyma in the early mine partially consumed; it may mine down into the leaf sheath, from which it enters another leaf. In later mines the leaf blade becomes rather inflated and the parenchyma nearly all consumed. The larva is pale yellowish, prothoracic shield marked with two posteriorly broadening and darkening dorsal stripes, ending in confluent or nearly confluent blackish spots. The pupa (fig. 38) lies beneath a slight cocoon of transversely placed threads; cuticle shining, with prominent rounded tubercles on the mesothorax, and sculptured dorso-lateral ridges, but mid-dorsal area smooth.

This species is characterized by the silvery white head, silvery white wing markings, with white basal patch and complete fascia.

(30) **Elachista sylvestris** Braun (Figs. 28, 35, 81, 128, 128a.)

1920. *Elachista sylvestris* Braun, Ohio Journ. Sci., xx, 169. Type ♂, Cincinnati, Ohio [A. F. B. Coll.].

1923. *Aphelosetia sylvestris* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 222.

Face and head silvery gray, with a slight yellowish tinge, occasionally darkening to leaden metallic and shading to golden brown or dark gray behind; palpi silvery, with the lower and outer surface of second segment blackish, third segment toward apex with a little black outwardly. Antennae blackish brown, apical fifth whitish in both sexes. Thorax and fore wings blackish brown with a faint golden brown luster; tips of tegulae and tip of mesothorax silvery; a silvery patch at base of wing broadest on dorsum; a slightly irregular silvery fascia just before middle, its costal half a little oblique; a silvery tornal spot reaching middle of wing and a costal silvery spot a little beyond it reaching to or slightly beyond middle of wing and curving a little outwardly in the middle of the wing. Cilia dark brown, a little paler opposite apex; scales around apex

forming a contrasting line. Hind wings narrow and acuminate, dark brown. Legs dark brown, tips of segments silvery and a silvery band around basal third of hind tibiae. Abdomen dark brown above, silvery beneath.

Alar expanse: 8 to 8.5 mm.

Male genitalia (fig. 81): gnathos rounded; sacculus processes rather broad, laterally flattened; anellus broad, the lobes obliquely truncate and acutely produced at apex; vinculum anteriorly bluntly produced; aedeagus slender, no cornutus.

Female genitalia (figs. 128, 128a): dilated portion of ductus bursae before ostium funnel-shaped; ventral margin of ostium deeply concave, the membrane sclerotized dorsally and laterally bearing two acute rods; ductus bursae sclerotized into segment 6, at inception of ductus seminalis two opposing teeth; bursa copulatrix minutely spiculate, signum a broad dumb-bell-shaped dentate plate.

Specimens examined: 14 ♂, 19 ♀.

Ohio: Cincinnati, ♂ type, rearing record B.1007, imago, May 30, 1919 [A. F. B. Coll.]; 7 ♂, 15 ♀ paratypes, rearing record B.1007, imagoes May 30 to June 6, 1919 [A. F. B. Coll. and A. N. S. P.]; 4 ♂, rearing record B.1007, imagoes May 22 to May 27, 1920; 1 ♂, on "Poa sylvestris," imago May 21, 1945; 1 ♀, flying, June 5, 1909; Clermont County, 2 ♀, rearing record B.1007, imagoes May 26 and 29, 1938 [A. F. B. Coll.].

Illinois: Oconee, 1 ♀, June 16–23 [U. S. N. M.].

New Hampshire: Hampton, 1 ♂, VI–25–1907 (S. A. Shaw), [U. S. N. M.].

The larva mines the stem leaves of *Poa sylvestris* A. Gray in April and early May. No egg-shells were found on any of the mined leaves; the earliest mine observed was an inconspicuous linear mine one and one-half to two inches in length along the margin of the leaf (fig. 28). The larva deserts this mine, entering a leaf near the tip and mining downward, consuming most of the parenchyma; this mine is white and extends across the leaf blade; it may be as much as three inches long. The larva is entirely pale yellow. Pupa (fig. 35) without cocoon, but with a few irregularly placed strands of silk; cuticle yellowish, shining only toward head; thorax beaded and sculptured, tubercles, particularly one pair, prominent; vertex lobed and emarginate.

This species is fairly common and the mines are easily observed on this common woodland grass in early May.

This is our only species with narrow acuminate hind wings and white-tipped antennae. In the fore wings vein R_3 (9) is connate with the stalk of R_4, R_5 and M_1.

(31) **Elachista nitidiuscula** new species (Figs. 78, 125, 125a.)

Face pale silvery gray, becoming darker on vertex; head dark bronzy brown posteriorly; palpi outwardly blackish, pale silvery gray inwardly and above; antennae dark gray. Thorax dark bronzy brown with the posterior half of the tegulae and mesothorax silvery gray. Fore wings narrow, dark bronzy brown with silvery white or faintly golden tinged markings; a silvery patch at base of wing, broadening toward dorsum and sometimes somewhat produced along it; a rather broad, slightly oblique silvery fascia before middle; a triangular silvery spot at tornus, and beyond it on costa, a larger silvery spot curving to the middle of the wing, where it usually expands and may send toward base a fine line of silvery scales which joins the apex of the tornal spot. Cilia dark brownish gray, a little paler opposite apex, with the row of dark scales well defined and contrasting. Hind wings narrow, acuminate, brownish gray, faintly bronzy. Legs dark bronzy brown, with the usual bands and tips of segments silvery. Abdomen dark bronzy brown above with some silvery shading, silvery beneath.

Alar expanse: 6.5 to 7 mm.

Male genitalia (fig. 78): uncus very deeply cut, base of sinus lower than outer margins of the lobes; sacculus processes broad, much flattened, thus appearing slender when viewed ventrally (*cf.* the figure); anellus narrow, its lobes tapering to their produced apices; vinculum produced into a long parallel-sided prong; aedeagus slender, no cornutus.

Female genitalia (figs. 125, 125a): ostium and ductus bursae closely resembling the corresponding parts in *sylvestris,* except that the ductus bursae bears a group of four teeth at the inception of the ductus seminalis; bursa copulatrix spiculate, signum a sinuate band bearing five or six teeth toward each end.

Type.—♂, Cincinnati, Ohio, July 3, 1907, in a swamp (A. F. Braun), [A. F. B. Coll.].

Allotype.—♀, same data as the type.

Paratypes.—1 ♂, Cincinnati, Ohio, June 27, 1907, in the same swampy area as the type [A. F. B. Coll.]; 5 ♂, Ottawa, Canada, 27.V.1906, 31.V.1906, 1.VI.1906 (2 specimens), July 21, 1934 (C. H. Young); 1 ♂, Black Rapids, Ontario, 26,V,1927 (G. S. Walley), [C. N. Coll., No. 5742]; 1 ♂, Nantucket, Mass., July (Cockerell), [U. S. N. M.]; 1 ♂, Winnipeg, Manitoba, 22.VI. (Fredk Knab, Collector), [U. S. N. M.].

Food plant and early stages unknown.

In appearance this species suggests a diminutive and narrow winged *sylvestris,* but is at once separated from that species by its entirely dark antennae. The genitalia indicate the near relationship to *sylvestris.*

In size and wing pattern it resembles *radiantella,* but in *nitidiuscula* the venation is not reduced (*i.e.* in *nitidiuscula* M_2, $M_3 + Cu_{1a}$ and Cu_{1b} are all present in the fore wing, and M_3, Cu_{1a} and Cu_{1b} in the hind wing). In *solitaria,* the only other small species similarly marked, the metallic basal patch does not reach the dorsum, and M_3 of the hind wing is absent.

(32) **Elachista cucullata** Braun (Figs. 40, 40a, 41, 90, 90a, 130.)

1921. *Elachista cucullata* Braun, Ohio Journ. Sci., XXI, 206. Type ♂, Cincinnati, Ohio [A. F. B. Coll.].

1923. *Aphelosetia cucullata* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 222.

Face and head silvery white, collar black; palpi white, second segment dark brown outwardly, third sometimes with dark shading outwardly; antennae black. Thorax black, tip of mesothorax white. Fore wings, M_1 from base of R_{4+5}; dark brown, nearly black, with a faint golden or bronzy luster; almost at base, a silvery fascia broadest on dorsum; just before middle, a curved silvery white fascia ends abruptly before reaching the dorsal margin; this fascia is sometimes reduced to a bar from costa to the middle of the wing, with a detached spot on fold; a triangular silvery spot at tornus, and beyond it a longer curved and oblique silvery costal spot. Cilia grayish brown, with the row of black scales around apex contrasting. Hind wings and cilia dark grayish brown. Legs dark brown, with the basal segments, tips of segments, and a broad band on the hind tibiae silvery. Abdomen blackish, silvery beneath.

Alar expanse: 8 to 9 mm.

Male genitalia (figs. 90, 90a): uncus not divided, slightly emarginate, with short heavy sinuate hairs; gnathos two spined knobs, the spines long; free process from harpe greatly developed and forming an inflated pocket, sacculus process arising from a broad base, narrowing, then broadly and flatly expanding; anellus lobes with tufts of long hairs at apex, lateral margins strongly sclerotized and thickened; vinculum broadly rounded, not produced; aedeagus tapering, armed at tip with several short spines, and before tip with two long very slender spines.

Female genitalia (fig. 130): hairs of the ovipositor lobes shorter and thicker than usual; at the anterior edge of ostium the genital plate is produced as a strongly sclerotized lobe; ductus bursae sclerotized nearly to segment 6, abruptly widening at inception of ductus seminalis, thence very gradually widening to the bilobed spiculate bursa copulatrix; signum a narrow dentate, very obtusely angled plate.

Specimens examined: 29 ♂, 23 ♀.

OHIO: Cincinnati, ♂ type, rearing record B.1026, imago May 19, 1920; 1 ♂, 1 ♀ paratype, under rearing record B.1026, imagoes, May 13, May 26, 1920

[A. F. B. Coll.]; 14 ♂, 7 ♀ paratypes, under rearing record B.1030, imagoes May 20 to May 25, 1920 [A. F. B. Coll., U. S. N. M., A. N. S. P.]; 2 ♂, 4 ♀, flying, June 5 to 26 [A. F. B. Coll.].

PENNSYLVANIA: Hazelton, 4 ♂, June 19 to June 30, 4 ♀, July 5 (W. G. Dietz), [M. C. Z.].

NEW JERSEY: Essex County Park, 5 ♂, 2 ♀, June 17 to July 7 (W. D. Kearfott), [U. S. N. M.].

ONTARIO: Ottawa, 1 ♂, 5 ♀, July 2–4, 1933 and 1934 (C. H. Young), [C. N. Coll.].

NEW MEXICO: Ruidoso Canyon, 1 ♂, June 30, 1939 [A. F. B. Coll.].

The larvae mine leaves of several narrow-leaved species of *Carex*, especially *Carex Jamesii* Schwein. During the autumn, the larva makes a narrow linear mine from the tip downward along the midrib; in the spring the mine is enlarged and occupies most of the breadth of the leaf, with parenchyma consumed and midrib of the leaf elevated into a ridge on the upper side, so that the mine appears inflated. By the middle of April (in the latitude of Cincinnati) the larvae are full grown. The full-grown larva is predominantly red; head brownish red, thorax with mid-dorsal line, and abdomen with mid-dorsal and lateral lines paler, pinkish. The pupa is attached by the anal end and held by a median silken girdle. It retains the coloration of the larva, with median and lateral ridges pinkish. It belongs to the elongate type with dull cuticle. The median dorsal ridge (figs. 40, 40a, 41) is elevated into a high sharp keel, which extends onto the thorax, joining the vertex, which forms a pointed hood projecting over the face; lateral ridges and lateral thoracic tubercles also prominent.

This species is easily separated from all other known American species in all stages. The coloration of the larva, the extreme elevation of the median ridge of the pupa contrasting with other species, wing markings and genitalia are all distinctive. The most apparent marks of identification of the moth are the abrupt ending of the median fascia before attaining the dorsum, and the dark ground color at the extreme base of the wing preceding the silvery basal fascia.

(33) **Elachista agilis** Braun (Fig. 93.)

1921. *Elachista agilis* Braun, Proc. Acad. Nat. Sci. Phila., LXXIII, 16.

Type ♂, Glacier National Park, Montana [A. F. B. Coll.].

Head dark leaden gray, shining; palpi dark brown, slightly paler above, grayish; antennae dark brown. Thorax dark leaden metallic. Fore wings dark

brown, with golden reflections, and metallic silvery or golden markings; at basal fourth on dorsum an oblique spot reaching the fold; at middle of costa a transverse spot reaching nearly to fold, and beneath it a small roundish spot below fold; a spot at tornus and near apex a curved costal streak nearly enclosing the apex. Cilia brown, row of scales around apex defined against the cilia. Hind wings and cilia brownish gray. Legs dark brown, with the femora, apex and spurs of hind tibiae only, and tips of tarsi silvery. Abdomen dark brown, silvery beneath.

Alar expanse: 7 mm.

Male genitalia (fig. 93): uncus divided, lobes approximate, with short stiff setae; gnathos two knobs, each broadly elliptical, spines long; costal area of harpe expanded, free process of harpe short and broad, sacculus process slightly enlarging toward apex; anellus lobes broad, truncate, lateral margins thickened; vinculum broad, anteriorly broadly rounded, not produced; aedeagus tapering, cornuti three equally spaced weak spines at tip of vesica.

Known only from the male type and male paratype [A. F. B. Coll.]; Goat Mountain, Glacier National Park, Montana, altitude 5000 feet, July 18, 1920.

Food plant and early stages unknown.

Very distinct from all other American species, but approaching the European *trapeziella* Stainton. Venation typical of the section.

(34) **Elachista leucosticta** new species (Figs. 89, 89a.)

Head shining dark yellowish gray; palpi dark brown, whitish inwardly and above; antennae dark brown. Thorax and fore wing dark brown; on the middle of the dorsum an irregular white spot reaching the middle of the wing, indented on the fold with a suggestion of a black plical spot (stigma); at two-thirds of costa an oblique white bar to middle of wing and a little beyond it, a smaller and triangular tornal spot; extreme tip of wing white; cilia dark gray, with the scales around apex very elongate and scarcely contrasting with the cilia. Hind wings and cilia dark brownish gray. Legs dark brown, with a broad white band on hind tibiae; tips of segments white.

Alar expanse: 6.5 mm.

Male genitalia (figs. 89, 89a): uncus deeply divided, lobes narrow elongate, with short stiff setae on upper half only; gnathos, two elongate elliptical knobs, each borne on a long arm; costal area of harpe expanded, free process small, sacculus reduced, basal processes rather short, club-shaped, with a few scattered setae; anellus lobes curved, deeply concave laterally; vinculum triangular; aedeagus short, tapering to a point, no cornutus.

Type.—♂, Constance Bay, Ontario, 21.VI.1933 (G. S. Walley), [C. N. Coll., Type No. 5744].

Food plant and early stages unknown.

By the male genitalia, this species is allied to the European *serricornis* Stainton.

(35) **Elachista texanica** Frey and Boll

1876. *Elachista texanica* Frey and Boll, Stett. Ent. Zeit., XXXVII, 216. Type locality, Dallas, Texas. [Location of type unknown.]

Doubt as to the generic position of this species was expressed by Frey. As the type is not in the British Museum where Frey's material should be, it is impossible to determine whether or not it is an *Elachista*. The species was thus characterized:

A plump little creature with retreating head, but in palpi, an *Elachista*. Its color is a dark lusterless brown. Head, thorax and abdomen dark brown. Face and palpi lighter and more shining gray; antennae gray, with darker annulations. Legs dark shining gray-brown, spotted with white; tarsi annulate with white. The fore wings dark brown, here and there with single scattered lighter yellow scales, and so peculiarly marked as to remind one of a *Gelechia*. At the base of the dorsal margin, a convex orange spot. A second, large and ill-defined, occupies the apical part of the wing; it begins on the costal margin at one-third the wing length. Cilia pale gray, around apex with a double darker line. Hind wings and cilia brownish gray, not especially dark.

If *texanica* is an *Elachista*, it is very distinct from all American species. When rediscovered, it should be easily recognized by the characteristic markings and coloration.

(36) **Elachista maritimella** McDunnough (Figs. 85, 85a, 132.)

1942. *Elachista maritimella* McDunnough, Canad. Ent., LXXIV, 224. Type ♂, Bathurst, New Brunswick [No. 5269, Can. Nat. Coll.].

Head whitish; palpi wholly white in the palest specimens, varying to dark fuscous on the lower and outer sides of the second segment in darker, dusted specimens; antennae brownish, with pale annulations. Fore wings very pale ocherous, with faintly indicated whitish irregular fasciae before the middle and at two-thirds; in darker specimens, in which the scales of the ground color are brownish-tipped, the median fascia is better defined, and the second fascia is broken into the usual pair of costal and dorsal spots. Cilia yellowish; in the darkest specimens a row of narrowly dark-tipped scales toward tornus. Hind wings pale smoky; in the darker specimens darkened and irrorate with grayish brown. Both pairs of wings beneath varying from immaculate whitish ocherous to densely grayish brown dusted. Legs whitish, more or less shaded with fuscous, in proportion to the general darkening of the wings. Abdomen usually pale yellowish, but in the darker specimens, entirely fuscous, except the anal tuft.

Alar expanse: 9 to 10 mm.

Male genitalia (figs. 85, 85a): of the usual type of the section; lobes of uncus large; gnathos a small spined knob; sacculus processes club-shaped; anellus lobes tapering to a point; vinculum produced into a point; aedeagus produced basally into a short blind sac; cornuti, one short broad-based spine and a group of minute spines.

Female genitalia (fig. 132): lobes of ovipositor elongate; ductus bursae sclerotized well into segment 6, its not-greatly dilated part before ostium cylindrical; ostium spinulate; bursa copulatrix spiculate, signum crescentic, arms dentate.

Specimens examined: 22 ♂, 11 ♀.

New Brunswick: Bathurst, 1 ♂ paratype, 24.VI.1941 (T. N. Freeman), [A. F. B. Coll. *ex* type series]; 1 ♂ paratype, 24.VI.1941 [in U. S. N. M. *ex* type series].

Nova Scotia: Parrsboro and Ottawa House, Parrsboro, 20 ♂, 11 ♀, 29.VI.1944 to 8.VII.1944 (J. McDunnough), [C. N. Coll.].

Food plant and early stages unknown.

In the original description Dr. McDunnough wrote: "The [type] series was taken on the salt coastal meadows a few miles north of Bathurst."

Maritimella can not be allied to the European *subalbidella* Schläg., as McDunnough suggests, as this latter species by genitalia (see Pierce and Metcalfe, Genitalia of the British Tineina, 1935, Plate XXV) belongs in Section I, in which the cell of the hind wing is closed. In wing markings, darker specimens of *maritimella* resemble *staintonella* Chambers.

(*37*) **Elachista staintonella** Chambers

1878. *Elachista staintonella* Chambers, Bull. U. S. Geol. and Geogr. Surv. of Terr., IV, 96. Type ♂, Texas [M. C. Z., Type No. 1514].

1880. *Elachista staintonella* Chambers, Journ. Cin. Soc. Nat. Hist., II, p. 204, fig. 49.

Head and palpi creamy white, antennae creamy white with faint fuscous annulations toward apex. Fore wings pale ocherous, with brownish dusting; an irregular angulated creamy white fascia before middle and a faintly defined narrower acutely angulated fascia at two-thirds, narrowed toward dorsum, its angle reaching nearly to apex. The ocherous basal third of the wing is dusted only in the costal half, and dorsally shades into the whitish fascia; the dusted ocherous band between the two whitish fasciae is widest on costa; dusting somewhat denser at apex. Cilia pale ocherous, with the brown-tipped scales projecting into them around apex and along termen. Hind wings yellowish white, with fuscous dusting; cilia pale ocherous.

Alar expanse: somewhat greater than the "three lines" given by Chambers.

Known only from the male type in the Museum of Comparative Zoology.

The venation of this species is not correctly delineated by Chambers in his figure of the wings; vein M_1 is out of the stalk of R_{4+5} in the fore wing; in the hind wing, M_3 is present (not absent) although very indistinct; the hind wing is rather narrow (as figured by Chambers).

E. staintonella appears to be related to *maritimella* McDunnough; the denser brownish dusting defines the markings more clearly than in that species.

(38) **Elachista cana** Braun (Fig. 87.)

1920. *Elachista cana* Braun, Ohio Journ. Sci., xx, 172. Type ♂, Tolland, Colorado [A. F. B. Coll.].

Head white; palpi white, shaded with fuscous beneath; antennae white, shading to dark fuscous at tip. Thorax and fore wings dull white. Base of costa fuscous; wing slightly dusted with pale ocherous fuscous-tipped scales, which, when not too sparse, are seen to be arranged in three lines, one below costa from basal third and running into the cilia at apical third, a second along middle of fold and passing upward and outward nearly to apex, a third below the fold and running into it near the margin. Apex of the wing sometimes faintly ocherous tinged and with a few minute dark specks in the extreme apex. Cilia white with a slightly darker bar opposite the dusted apex. Hind wings pale gray, cilia darker. Legs white, tarsi fuscous. Abdomen fuscous above, white beneath.

Alar expanse: 8.5 to 9.5 mm.

Male genitalia (fig. 87): uncus lobes rather small, widely separated, the space between them quadrate, and wider than long; gnathos ovoid; sacculus processes broad; anellus narrow, its lobes tapering, transversely wrinkled; vinculum produced in a blunt lobe; aedeagus tapering, cornutus a short spine.

Specimens examined: 5 ♂.

Colorado: Tolland, 9000 feet, ♂ type, 2 ♂ paratypes, August 10, 1919; Sangre de Cristo Mountains, Alpine Lodge, 8800 feet, 2 ♂, July 6 and July 11, 1934 [A. F. B. Coll.].

Food plant and early stages unknown.

The white ground color and the lines of darker scales separate this species from all others of this section of the genus, except the following species, in which however, the scales of the ground color are minutely gray-tipped.

(39) **Elachista amideta** new species (Fig. 88.)

Head pale gray (the scales white, minutely tipped with gray); palpi white, the second segment dark gray beneath and outwardly, third segment gray outwardly except at base; antennae pale gray, fuscous toward tips. Scales of the thorax and fore wings white with pale gray tips, producing the effect of a pale gray ground color; the costal area, especially near base, from costal margin to the upper margin of the cell is somewhat darker than the remainder of the wing; darker and more broadly gray-tipped scales form indistinct longitudinal lines on the wing; one of these lies just above the fold, and is directed toward apex, nearly joining a short line of dark scales which extends to the extreme tip of the wing and is continued as a dark pencil in the apical cilia; a third dark line runs below the fold, meeting it at the wing margin. Cilia grayish white except opposite the apex. Legs pale gray, tips of segments white. Abdomen gray mid-dorsally, elsewhere white.

Alar expanse: 9.2 mm.

Male genitalia (fig. 88) similar to *cana,* but with the space between the uncus lobes parabolic in shape; harpe more slender; anellus broader with more transverse wrinkles; aedeagus much more slender in the outer half, cornutus a short bent spine, stouter than in *cana.*

Type.— ♂, Ottawa, Ontario, May 15, 1933 (C. H. Young), [Can. Nat. Coll., Type No. 5743].

Paratype.— ♂, same data as the type [C. N. Coll., No. 5743].

Food plant and early stages unknown.

In the type the longitudinal lines of darker scales on the fore wing are more apparent than in the paratype. *E. amideta* is nearest to *E. cana* from which it is distinguished by the general gray color in contrast to the white color of that species; in the male by differences in genitalia, as noted.

(40) **Elachista inaudita** Braun (Figs. 43, 129.)

1927. *Elachista inaudita* Braun, Canad. Ent., LIX, 56. Type ♀, Sparrow Lake, Ontario [A. F. B. Coll.].

Head and appendages dark brassy brown; palpi paler above. Fore wings at base brassy brown, shading outwardly into dark blackish brown in the apical half, with a faint purple luster replacing the brassy luster of the base of the wing; an elongate creamy white spot in the fold near base; a large white spot on dorsum at the beginning of the cilia reaching to middle of wing; between these two spots the fold is darkened (plical stigma); a triangular oblique curved white spot on costa beyond the dorsal spot. Cilia purplish black. Hind wings and cilia dark brown. Legs dark brassy fuscous, spurs and tips of tarsi whitish. Abdomen brassy brown, posterior margins of segments beneath whitish.

Alar expanse: 10 mm.

Female genitalia (fig. 129): lobes of the ovipositor small, rounded; dilated part of ductus bursae before ostium deeply cup-shaped, spinulate, ostium scarcely wider; ductus bursae gradually less sclerotized from ostium anteriorly into the sixth segment; the ductus seminalis enters near the anterior margin of segment 7; bursa copulatrix pear-shaped, minutely and sparsely spiculate, signum a narrow dentate ridge on a weakly sclerotized elongate oval plate.

Known only from the female type, Sparrow Lake, Ontario, reared from a miner of leaves of *Scirpus* sp.; larva July 16, imago August 6, 1926, under rearing record B.1283.

The nearly full grown larva makes a rather broad gradually widening brownish mine extending toward the tip of the leaf; probably earlier and narrower mines are made by the younger larva. The pupa (fig. 43) is attached by anal end and held by a median girdle, with a few strands of silk placed irregularly across it. It is slender and very elongate, with cuticle dull and brownish, between the dorsal ridge and each lateral ridge, a dark brown stripe; the median dorsal ridge is elevated and extends forward onto the head, lateral ridges less prominent; mesothoracic tubercles low and rounded.

Very distinct from any other described American species. Relationship to *tanyopis* is suggested by the very similar female genitalia, and to *salinaris* by the similar slender pupa, in spite of the very different coloration.

(41) **Elachista tanyopis** Meyrick (Figs. 91, 131.)

1932. *Elachista tanyopis* Meyrick, Exot. Microlep., IV, 218. Type ♂, Parry Sound, Ontario, Canada [British Museum].

Head white tinged with ocherous in the darker specimens; palpi white, second segment brownish gray outwardly; antennae ocherous-gray, basal segment white. Thorax whitish or ocherous tinged, slightly darker than the head. Fore wings whitish ocherous, with the costal margin near base dark brown; more or less dusted with brownish ocherous scales, which are densest in the costal area and toward the pair of pale spots at two-thirds and acutely produced between them, thus defining their inner margins; an elongate black plical spot (stigma), the area before and beyond it sparsely or not at all dusted with darker scales. The pale spots at two-thirds are more or less obscured by dusting outwardly, the dorsal spot may have a group of darker scales at its outer margin. Cilia whitish ocherous, the marginal scales forming a dark line through them, which is broken on costa at apex by a white bar (more or less distinct) which may extend as a gradually narrowing white streak along the termen toward

tornus. Hind wings gray, contrasting by their dark color with the fore wings; cilia brownish, pale at bases. Underside of both pair of wings dark brown. Fore and middle legs mostly dark brown, hind legs whitish ocherous, with some dark shading faintly defining the usual pale bars and tips of segments. Abdomen brownish gray, with the terminal segments and underside whitish ocherous.

Alar expanse: 9 to 10 mm.

Male genitalia (fig. 91): uncus lobes with rather short curved setae; gnathos, two elliptical spined knobs; cucullus of harpe terminating apically in a strong spine, costal apical area semicircular, free process of harpe short, sacculus basally with a large circular depression fringed distally with inwardly directed hairs, sacculus processes broad at base and little widening outwardly, somewhat truncate viewed laterally; anellus lobes diverging, apex rounded with a few short setae; vinculum triangular; aedeagus tapering, cornutus a short spine arising from a greatly elongated sclerotized base.

Female genitalia (fig. 131): ovipositor lobes small and rounded; dilated part of ductus bursae before ostium deeply cup-shaped, sides straight, spinulate; ductus bursae sclerotized to the middle of the long segment 7; bursa copulatrix bulging to the right, smooth, signum a dentate knife-like ridge on a sclerotized diamond-shaped base.

Specimens examined: 10 ♂, 1 ♀.

ONTARIO: Bobcaygeon, 5 ♂, 22–VI–'31 (3 specimens), 15–VI–'31, 17–VI–'31 (J. McDunnough), [C. N. Coll.].

MAINE: Alton, 2 ♂, 1 ♀, June 28, 1938; 1 ♂, Southwest Harbor, July 5, 1937; Bangor, 1 ♂, June 24, 1938 (E. A. Brower), [A. N. S. P.].

NEW JERSEY: Whitesbog, 1 ♂, at light, June 22, 1940 (E. P. Darlington), [A. N. S. P.].

Food plant and early stages unknown, but the larva is probably a miner of some species of sedge or rush.

E. tanyopis is allied to the western *salinaris* Braun and to the European *rhynchosporella* Stainton, with which it agrees closely in characters of the genitalia. It is the only eastern North American species of *Elachista* in which the cucullus of harpe terminates in a spine, a character observable in the dry specimen. The contrastingly dark hind wings and different venation separate the palest specimens from any of the white species with dark plical spot.

(42) **Elachista salinaris** Braun (Figs. 45, 92.)

1925. *Elachista salinaris* Braun, Trans. Amer. Ent. Soc., LI, 210. Type ♂, Bear River Bay, Great Salt Lake, Utah [A. F. B. Coll.].

Head white; palpi white, second segment fuscous outwardly; antennal scape white, stalk pale fuscous. Thorax and ground color of fore wings white; extreme costal edge near base black; a narrow brownish shade along costa from

base to two-thirds where it broadens to form a triangular costal patch which is continued as an oblique jagged brown line across the wing to the termen; a large, elongate deep velvety brown spot (plical stigma) on the middle of the fold; a few brownish scales below the fold and a cluster of brownish scales on dorsum before tornus opposite the costal triangular patch; in the apical part of the wing, a few brownish yellow scales beyond the jagged brown line. Cilia white, faintly yellow-tinged, a row of brownish-tipped scales extending into them from a point opposite the apex to the tornus. Hind wings and cilia dark fuscous. Underside of both pairs of wings dark fuscous. Legs pale fuscous, hind pair white inwardly. Abdomen mid-dorsally fuscous, paler at tip and sides, whitish beneath.

Alar expanse: 11 mm.

Male genitalia almost identical with those of *tanyopis;* the only appreciable difference is in the shape of the lobes of the anellus (fig. 92); the upper margins are thickened, evenly and broadly rounded and without setae, the lateral margins more deeply concave.

Specimens examined: ♂ type, ♂ paratype.

UTAH: Bear River Bay, Great Salt Lake, ♂ type, ♂ paratype, under rearing record B. 1141, imagoes June 29, 1924 [A. F. B. Coll.].

The larva is a miner of leaves of *Scirpus paludosus* A. Nelson. The mine is long, irregular, varying in width from one to three millimeters; in some places nearly transparent, elsewhere packed with frass; its early portion is scarcely visible, later, the parenchyma is consumed and the mine more apparent. The mines from which the types were reared were collected June 14, when the larvae were nearly full grown.

The pupa (fig. 45) is very slender, elongate, cuticle dull; median dorsal ridge low, but extending onto the thorax, lateral ridges prominent; thorax sculptured along mid-dorsal line, the usual tubercles low, rounded and inconspicuous. The pupa is remarkable in that the spiracles of the first abdominal segment are visible. No cocoon; the pupa is attached to a leaf by anal end and a median girdle.

Nearest to *tanyopis,* but easily separated from it by the pure white ground color of the fore wings, with absence of dark dusting.

(43) **Elachista praelineata** Braun (Figs. 30, 44, 99, 99a, 134, 134a, 134b.)

1915. *Elachista praelineata* Braun, Canad. Ent., XLVII, 106. Type ♀, Cincinnati, Ohio [A. F. B. Coll.].

1916. *Elachista praelineata* Mosher, Bull. Ill. State Lab. Nat. Hist., XII, Art. II, p. 106, Pl. XXVI, fig. 100.

1923. *Aphelosetia praelineata* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 222.

Face pale gray, darker speckled, head gradually darkening to grayish black posteriorly; palpi dark fuscous beneath, paler above with tip of second segment, a broad band and extreme tip of third segment blackish, these markings more sharply defined in the female. Antennae black with paler annulations, last one or two segments pale. Thorax black, with tips of tegulae and mesothorax white. Fore wing, venation typical; black; from base of costa to dorsum narrowly white with a slight yellowish tinge; before middle, a curved white fascia, narrow in male; at tornus, a triangular white spot, and nearly opposite on costa, a similar costal spot. Apical row of scales black and sharply contrasting with the cilia which are white around apex, dark gray elsewhere. Hind wing, M_3 absent; dark gray. Legs black, inwardly silvery; tarsal segments white-tipped, hind tibiae with the median silvery band broad. Abdomen dark fuscous above, silvery beneath, the dense abdominal tuft of the female pale yellowish gray, with a greater or less admixture of dark gray in the median line.

Alar expanse: 6.5 to 7.5 mm.

Male genitalia (figs. 99, 99a): uncus lobes widely separated, incurved, sinus quadrate; gnathos ellipsoidal; harpe extremely narrow and long, with cucullus greatly reduced, sacculus process a slender rod; lobes of anellus slender, curving to the pointed tips; aedeagus bifid at tip, cornuti a mass of microscopic spines.

Female genitalia (figs. 134, 134a, 134b): genital segments largely membranous; lobes of ovipositor pointed; bursa copulatrix small, smooth, without signum; ductus bursae membranous throughout, abruptly dilating to the wide ostium, which is minutely spiculate dorsally and sclerotized on its ventral margin only. Seventh tergite with sclerotized plate bearing a dense mass of knobbed hairs, with four clusters of still more densely packed hairs (figs. 134a, 134b).

Specimens examined: 5 ♂, 8 ♀.

Ohio: Cincinnati, ♀ type, under rearing record B.836, imago August 8, 1914; 3 ♂, 4 ♀ paratypes, B.836, with dates of emergence August 2 and 4, 1914 [A. F. B. Coll. and U. S. N. M.]; 2 ♂, 2 ♀, rearing record B.836, with dates of emergence July 31 to August 6, 1919 [A. F. B. Coll.]; 1 ♀, rearing record B.1016, imago September 2, 1919 [A. N. S. P.].

The larva is a miner of leaves of *Hystrix patula* Moench. (and rarely of *Elymus*) in July. By a twist of the petiole, the true upper side of the leaf of *Hystrix* faces downward; the following description of the mine, and the figure (fig. 30) give the aspect as seen in the field, viewing what is in fact the lower side of the leaf. The early mine is a narrow line scarcely visible above; it gradually enlarges into an elongate blotch, with the greatest width about 4 mm.; except in the widest portion of the mine, the parenchyma is only consumed adjacent to the true upper epidermis and the mine as seen from above is green; even in the blotch, patches of green tissue remain. Below, the mine is whitish

and distinctly visible throughout; the tissue adjacent to the true upper epidermis has been completely consumed. The specimens under B.836 were reared on *Hystrix,* the single specimen under B.1016 on *Elymus,* all from the same locality in a dry hillside woods.

Pupa (fig. 44) shining, attached at anal end and by a median girdle and covered by a few criss-cross silken threads. Vertex and prothorax strongly tuberculate, the usual mesothoracic tubercles prominent, with additional associated small tubercles; wings with lines of small tubercles.

In general appearance, *E. praelineata* resembles *E. leucofrons,* but is easily distinguished from it by the smaller size, reduced venation of the hind wing, early stages and genitalic characters; the last definitely place it in the *radiantella* group.

(44) **Elachista solitaria** Braun (Figs. 26, 29, 46, 46a, 97, 97a.)

1922. *Elachista solitaria* Braun, Canad. Ent., LIV, 93. Type ♂, Powell County, Kentucky [A. F. B. Coll.].

Face silvery gray, shading to dark brown on the head posteriorly; palpi drooping, longer than in *radiantella,* silvery gray, third segment blackish outwardly; antennae dark brown, slightly thickened in the male, with outer half serrate, without pecten (or if present concealed by the scales overlapping the base of the scape). Thorax silvery gray with bronzy reflections, except anterior border, which is dark brown. Fore wing, venation typical; dark brown, with a scarcely distinguishable reddish luster; a small silvery gray spot at base of costa not reaching below fold; a slightly curved brilliant silvery fascia just before middle; a narrow perpendicular silvery spot at tornus, and beyond it near apex, a larger curved silvery costal mark dilated in the middle of the wing and extending almost to the tip. Apical scales in the male of equal length and forming an even line in the cilia which are white opposite the apex, dark brown elsewhere. Hind wing, M_3 absent; dark brownish gray. Legs dark brown, femora, tips of segments and a broad band around hind tibiae silvery. Abdomen dark brown above with bronzy luster, silvery beneath in the male (female unknown).

Alar expanse: 5 to 5.5 mm.

Male genitalia (figs. 97, 97a): uncus lobes widely separated, incurved, but sinus between them shallow; gnathos knob-shaped; harpe elongate, narrow, cucullus greatly reduced, free process thus seeming to arise near apex and setose for half its length; sacculus processes very minute, spoon-shaped; anellus lobes obliquely truncate; aedeagus produced at apex into a hook, cornuti a mass of microscopic spines.

Specimens examined: 5 ♂.

KENTUCKY: Powell County, ♂ type, under rearing record B.1068, with emergence of the imago July 10, 1921; 1 ♂, rearing record B.1084, imago, June 11, 1922; 2 ♂, rearing record B.1085, June 15, 1922 [A. F. B. Coll.].

OHIO: Mineral Springs, Adams County, 1 ♂, under rearing record B.1415, imago, July 10, 1931 [A. F. B. Coll.].

The larvae mine leaves of several species of *Panicum.* Mining larvae may be found from the end of May to the end of June, depending on the season; the mine of the type was collected June 26, the mines, B.1084, B.1085, May 28, and the mine, B.1415, June 27. The egg (fig. 26) is flattened ovoid, with branching and anastomosing ridges, and is placed on the upper side of the leaf. The mine (fig. 29) at first very narrow with a conspicuous line of frass, later enlarges into a whitish translucent blotch.

The pupa (figs. 46, 46a) is covered by a very slight cocoon, and is attached to the pupating surface by the anal end and a silken median girdle; cuticle shining. It resembles that of *radiantella,* but differs from it in the more prominent ridges of the abdomen, larger mesothoracic tubercles, in sculpturing of thorax and head, and, principally, by the presence of lines of tubercles on the wings.

There are probably two generations a year as in *radiantella.*

A rare species, probably of more restricted range than *E. radiantella,* its nearest ally, from which it is distinguished by venation—M_2 of fore wing present and cubitus of the hind wing forked; by basal wing markings and by differences in male genitalia. The female is unknown, but when discovered will doubtless possess the dense abdominal tuft present in the other two species of the group.

(45) **Elachista radiantella** Braun (Figs. 8, 20, 23, 42, 98, 98a, 133, 133a, 133b.)

1922. *Elachista radiantella* Braun, Canad. Ent., LIV, 92. Type ♀, Washington, D. C. [U. S. N. M.].

Face silvery or leaden gray, slightly opalescent; head dark brown above, with faint reddish luster; palpi very short (fig. 8), drooping, silvery gray, dark brown outwardly; antennae dark brown, paler toward tip in female, somewhat thickened in male, pecten reduced to a few short hairs near base of scape. Thorax dark brown, tips of tegulae and mesothorax silvery. Fore wing, M_2 absent, R_{4+5} united (fig. 20); dark brown with a faint golden luster, markings silvery with golden and opalescent luster (especially marked in the female); an oblique fascia almost at base; a nearly perpendicular fascia just before

middle; a silvery transverse spot at tornus, and beyond it on costa near apex a larger curved silvery spot extends nearly to termen below apex and in the female often expands below apex. In the female the apical scales are short and of equal length, and form a sharply defined broadly curved line around apex, contrasting with the paler cilia; in the male, these scales are of uneven length, some nearly as long as the cilia, and there is no defined line in the cilia. Hind wing, M_3 absent, and Cu_1 unbranched (fig. 20); brownish gray, darker in the male. Legs dark brown, femora, tips of segments and a broad band around hind tibiae silvery. Abdomen dark brown above, silvery beneath; seventh segment in the female with a large dense dorsal tuft of long knobbed dark brown hairs concealing the tip of the abdomen.

Alar expanse: 5.5 to 6.4 mm.

Male genitalia (figs. 98, 98a): uncus lobes widely separated, incurved; gnathos knob-shaped; harpe narrow, free process setose to its tip, sacculus process spoon-shaped and closely appressed; anellus lobes broad, obliquely truncate, aedeagus produced into a curved spine at apex, cornuti a row of minute spines.

Female genitalia (figs. 133, 133a, 133b): genital segments largely membranous; lobes of ovipositor rounded; ductus bursae membranous and of equal diameter throughout; ostium no broader than the ductus, minutely spiculate, its ventral margin only sclerotized; bursa copulatrix smooth, no signum. Seventh tergite with sclerotized plate bearing closely packed knobbed hairs (figs. 133a, 133b), concealing the genital segments.

Specimens examined: 19 ♂, 20 ♀.

District of Columbia: Washington, ♀ type, on *Panicum*, record number 8844, iss. July 18, 99 (A. Busck), [U. S. N. M.]; 1 ♂ paratype, record number 8844, iss. July 20, 99 [U. S. N. M.]; 1 ♀ paratype, same data as the type [A. F. B. Coll.].

Virginia: Falls Church, 1 ♂, May 8–15 (Wm. Middleton), [U. S. N. M.].

Ohio: Clermont County, 13 ♂, 13 ♀, under rearing record B.1411, with dates of emergence from June 28 to July 3, 1931; 1 ♂, 1 ♀, under B.1412, imagoes June 28, June 29, 1931; Brown County, 1 ♂, 1 ♀, under rearing record B.1429, imagoes March 29, 1933 [A. F. B. Coll.].

Kentucky: Powell County, 1 ♀, rearing record B.1086, imago June 10, 1922; Fleming County, 1 ♂, 1 ♀, rearing record B.1902, imagoes July 25, 1941 [A. F. B. Coll.].

Maine: Monmouth, 1 ♂, 1 ♀, VI–20–06, "reared," (C. A. Frost), [U. S. N. M.].

The larvae mine leaves of various species of *Panicum*, most commonly *Panicum dichotomum* L. and *P. clandestinum* L. The egg is broadly ovoid, flattened, similar to that of *E. solitaria* (fig. 26), and is placed on the upper side of the leaf. The mine is at first a narrow

thread, then rather abruptly enlarges into a blotch, in which the leaf tissue is consumed, with frass irregularly scattered; the blotch may obliterate the early linear mine. The mines of *E. radiantella* and *E. solitaria* (fig. 29) are indistinguishable and may occur in the same area. The larva differs from other species examined in the longer head capsule, heavier prothoracic shield, and the very long setae (fig. 23).

The pupa (fig. 42) is of the shining cuticle type; it is attached to a surface by the anal end and a silken girdle and lies beneath a few irregularly placed silken strands. The lateral abdominal ridges are prominent, dorsal ridge not extending onto the thorax; in addition to the sculpturing and tubercles of thorax and head shown in the figure, there are prominent tubercles on the front of the head; the wings are without tubercles (compare *solitaria*).

More than one generation a year is indicated by the dates of collection of mining larvae. Larvae mining basal overwintering leaves, collected February 22, produced imagoes March 29, suggesting that the eggs had been deposited the previous summer or autumn. Mines under B.1411 and B.1412, collected June 17; B.1086, May 28, and B.1902, July 12, were apparently made by larvae hatching from eggs deposited in the spring, as all were on stem leaves of the grasses.

In venation, *E. radiantella* is the most reduced of any known species of the genus. Its extreme specialization is further indicated by the difference in aspect between male and female, especially in brilliance of markings, and scale structure and arrangement at the apex of the fore wing, and by the specialized scales of the abdominal tuft of the female.

Section III

(46) **Elachista madarella** (Clemens) (Figs. 3, 18, 32, 48, 95, 95a, 135.)

1860. *Cosmiotes madarella* Clemens, Proc. Acad. Nat. Sci. Phila., p. 9. Type ♀, Pennsylvania (? Easton) [A. N. S. P., Type No. 7397].

1872. *Elachista* (*Cosmiotes*) *madarella* Stainton, Tin. No. Am., p. 98.

1878. *Elachista madarella* Chambers, Bull. U. S. Geol. and Geogr. Surv. of Terr., IV, 139.

1903. *Cosmiotes madarella* Busck, Proc. Ent. Soc. Wash., V, 197.

1921. *Elachista madarella* Braun, Ohio Journ. Sci., XXI, 208.

1923. *Apheloseta madarella* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 221.

Head dark silvery gray, lower part of face paler, and posterior margin of head dark shining brown; palpi nearly straight (fig. 3), dark gray, paler above and concolorous with the face; antennae dark brown, apical fifth yellowish white. Thorax dark brown in anterior half, dark bluish metallic in posterior half. Fore wing dark brown, with faint golden reflections; base of wing silvery gray, with bluish reflections on costa and golden reflections toward dorsum; before middle a slightly oblique brilliant silvery or pale golden[18] metallic band, which is often extended along the wing below fold, or sometimes this extension represented by a small detached silvery or golden dot; at two-thirds the wing length, a silvery or pale golden costal spot, and opposite it a similar dorsal spot; beyond these in the middle of the wing near the apex, a silvery spot. Cilia grayish brown, paler around apex; the apical row of scales black-tipped and forming a sharply contrasting line. Hind wings grayish brown, cilia somewhat darker especially in the female; wing broader in the male. Legs dark silvery gray, hind tibiae mostly silvery in male, brown except at apex in the female. Abdomen dark brown with some metallic luster above, yellowish white beneath.

Alar expanse: 8 to 9 mm.

Male genitalia (figs. 95, 95a): uncus lobes with sparse short stiff setae; gnathos broader than long; free outgrowth of harpe reduced to a short projection at base, sacculus processes erect, stout, cylindrical, setose, arising near ventral angle; anellus lobes very broad, each lobe produced posteriorly into a broad setose lateral arm (concealed behind the sacculus process); the narrow ring-like sclerotization of the vinculum produced posteriorly in the mid-ventral line; aedeagus stout, three-lobed at base, a dorsal prong, apex pointed, manica apparently present; no cornutus.

Female genitalia (fig. 135): genital plate specialized, its anterior margin a heavily sclerotized concave band indenting the seventh segment; from its median posterior part an acute projection toward ostium, which opens in a large depressed membranous area; ventral margin of ostium sclerotized, laterally two weakly sclerotized recurved lines form a pair of semi-ellipses; the dorsal posterior margin of the eighth segment bears a row of strong setae (shown in the figure as broken lines beneath the lobes of the ovipositor); bursa copulatrix weakly bilobed, spiculate, signum a broad dentate band with slight median constriction; ductus bursae very wide, abruptly narrowing to the small ostium, with inception of ductus seminalis close to ostium.

Specimens examined: 23 ♂, 14 ♀, 7 sex undetermined.

Pennsylvania: ? Easton, ♀ type [A. N. S. P.]; Hazelton, one specimen, 6–9–04 (W. G. Dietz), [M. C. Z.].

New Jersey: Essex Co. Pk., 1 ♂, July 1, 2 ♀, June 24 (W. D. Kearfott), [U. S. N. M.].

New York: "Cent. N. Y.," 7 specimens, mostly without abdomen, 6–9–99, 6–30–99, 7–1–99 [M. C. Z.].

[18] With age the silvery metallic marks tend to acquire a golden tinge.

OHIO: Cincinnati, 8 ♂, 7 ♀, on leaves of *Carex* spp., under rearing records B.1028, B.1029, B.1035, B.1040, with dates of emergence from May 20 to June 28, 1920 [A. F. B. Coll. and A. N. S. P.]; 6 ♂, 2 ♀, on leaves of *Scirpus atrovirens,* under rearing record B.1039, with dates of emergence from June 1 to June 15, 1920 [A. F. B. Coll.]; 6 ♂, 1 ♀, captured on the wing from June 6 to July 19 [A. F. B. Coll.].

ONTARIO: Sparrow Lake, 1 ♀, July 17, 1926 [A. F. B. Coll.].

The larvae may be found early in the spring on *Carex* spp. and *Scirpus* spp., feeding on the overwintering leaves, indicating that mining was initiated during the preceding autumn. The larva mines down the old leaf, finally entering the leaf sheath of one of the new inner basal leaves, then working upward toward the tip of the leaf, feeding only at night and retiring down into the leaf sheath near the root-stalk during the day (fig. 32). Several leaves may be thus mined. The larva is whitish or pale green, prothoracic shield with a pair of conspicuous L-shaped dark marks.

Pupation takes place commonly on the upper side of a leaf over the midrib; the cocoon is a flat sheet of silk formed of two series of obliquely placed parallel threads crossing one another at an acute angle (as in *enitescens,* fig. 31). The dorsal abdominal surface of the pupa (fig. 48) is flattened, median and lateral ridges absent, spiracles produced; mesothorax delicately sculptured, and vertex transversely beaded.

E. madarella is easily separated from all other species except *enitescens* and *argentosa* by wing venation (fig. 18); from both of these it differs in the white tips of the antennae.

(47) **Elachista enitescens** Braun (Figs. 31, 47, 96, 96a, 136.)

1921. *Elachista enitescens* Braun, Ohio Journ. Sci., XXI, 207. Type ♂, near Cincinnati, Ohio [A. F. B. Coll.].

1923. *Aphelosetia enitescens* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 221.

Palpi and entire head dark leaden metallic, almost black; antennae grayish black throughout. Thorax and base of fore wing leaden metallic, with a reddish and purplish luster which is most decided at base of dorsum, where the leaden color is sometimes replaced by metallic golden or silvery scales like those of the fascia and spots. Fore wing dark brown, faintly shining; an oblique silvery or golden metallic fascia with reddish and purplish luster before the middle of the wing, broader in its dorsal half and sometimes produced outwardly below the fold; at two-thirds a silvery or golden metallic costal and an opposite dorsal spot; beyond them in the middle of the wing near the tip a silvery or golden

spot. These markings in some directions of light show a distinctly bluish luster. Cilia gray, with the apical scales forming a dark line through them. Hind wings dark brown, broader in male. Legs dark gray, hind tarsi paler tipped. Abdomen dark gray, underside yellowish.

Alar expanse: 7 to 8 mm.

Male genitalia (figs. 96, 96a): uncus lobes with short stiff setae near the outer margins; gnathos knob-shaped; free outgrowth of harpe reduced, sacculus processes erect, more slender than in *madarella,* and much exceeding the lateral arms of the anellus; anellus broad, lateral arms of lobes short with a few setae apically; vinculum with mid-ventral sclerotization (as in *madarella*); aedeagus three-lobed at base, middle lobe truncate; a blunt projection near apex, apex acutely acuminate; no cornutus.

Female genitalia (fig. 136): genital plate specialized, narrowly strongly sclerotized along anterior border, without median projection into the depressed membranous area in which the small ostium opens; lateral lines broadly curving from ostium; dorsal posterior margin of eighth segment fringed with long setae; bursa copulatrix very small, spicules scattered; signum a small dentate patch; ductus bursae tapering to ostium, inception of ductus seminalis near ostium.

Specimens examined: 3 ♂, 4 ♀.

Ohio: near Cincinnati, ♂ type, rearing record B.1036, imago June 8, 1920; 2 ♂, 2 ♀ paratypes, under B.1036, imagoes May 13 to June 7; 1 ♀, "on *Scirpus,*" June 8, 1921; Clermont County, 1 ♀, under B.1036, imago June 14, 1922 [A. F. B. Coll.].

In March and early April, the partially grown larvae are mining the old overwintering leaves of the bulrush, *Scirpus atrovirens* Muhl.; later the larva enters a new leaf at its base; the mine extends from the base of the leaf upward and may be four or five inches in length. The larvae feed only at night, retiring during the day to the base of the leaf, sometimes beneath the surface of the water. The larva is yellow with a pair of ill-defined irregular dark patches on the prothoracic shield posteriorly.

Pupation takes place over the midrib, beneath a flat cocoon (fig. 31) consisting of two series of obliquely placed parallel silk threads, crossing one another at an acute angle. The pupa (fig. 47) is very similar to that of *madarella,* but lacks the delicate sculpturing of the mesothorax and tubercles of the vertex.

E. enitescens differs from *madarella* in the wholly dark antennae, and in genitalic characters in both sexes.

(48) **Elachista argentosa** Braun (Figs. 27, 49, 94, 94a, 137.)

1920. *Elachista argentosa* Braun, Ohio Journ. Sci., xx, 168. Type ♂, Clermont County, Ohio [A. F. B. Coll.].

1923. *Aphelosetia argentosa* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 221.

Face and head silvery gray, with a bluish metallic luster; palpi silvery gray inwardly, fuscous beneath and outwardly; antennae deep blackish brown throughout, slightly thickened in male. Thorax deep golden brown, shading to metallic gray and silver behind. Fore wings almost black with faint golden brown reflections in some lights; markings metallic silvery, with golden and bluish reflections; base of wing silvery; a fascia just before middle produced a little toward tornus on dorsum; opposite costal and dorsal streaks at two-thirds, the costal curving outwardly in the middle of the wing and sometimes slightly dilated at its tip before apex, and rarely met by the dorsal streak. Cilia dark brown, apical scales forming a contrasting line. Hind wings broader in male, grayish brown, becoming bluish along costa near base. Legs silvery gray, middle tibiae and all the tarsi dark brown, and brown shading on the hind tibiae; tips of segments silvery. Abdomen shining fuscous above, silvery beneath.

Alar expanse: 7 to 8 mm.

Male genitalia (figs. 94, 94a): uncus lobes small, not separated at base, a few short setae near their outer margins; gnathos ellipsoidal; free outgrowth of harpe reduced, basal process of sacculus short, club-shaped, with long setae; posterior margin of anellus strongly sclerotized, each lobe prolonged into a finger-like process; vinculum broad, with a short anterior projection; aedeagus (fig. 94a) with an elongate dorsal, and a shorter ventral basal enlargement, apex dorsally produced into a long curved acutely pointed process; manica present; no cornutus.

Female genitalia (fig. 137): genital plate specialized, its median anterior margin strongly sclerotized and indenting the seventh segment; ostium opening in a broadly oval membranous area in the genital plate; the lateral lines from ostium nearly straight, but little divergent; dorsal posterior margin of eighth segment bearing about ten strong setae; bursa copulatrix large, bilobed, spiculate, signum an elongate dentate band; ductus bursae gradually narrowing to the small ostium, and sclerotized just before ostium; inception of ductus seminalis just anterior to this sclerotized ring.

Specimens examined: 12 ♂, 8 ♀.

Ohio: Clermont County, ♂ type, under rearing record B.1008, imago June 1, 1919; 2 ♂ paratypes under B.1008, imagoes June 2 and June 3, 1919; 3 ♀, under B.1083, imagoes June 1, June 7, 1922; Cincinnati, 8 ♂, 4 ♀, under rearing records B.1008, B.1034, B.1041, with dates of emergence from May 24 to June 13, 1920 and 1922; 1 ♂, 1 ♀, captured on the wing, June 7, 1906, and June 23, 1904 [A. F. B. Coll.].

The larvae mine leaves of species of *Carex,* most commonly the narrow-leaved species, during April and early May. The mine (fig. 27) extends from the tip of the leaf downward and lies nearer the upper side; the parenchyma is partially consumed and the mine appears greenish except near the point of exit over the midrib where the parenchyma is consumed and the epidermis wrinkled, forming a tunnel opening by a transverse slit to the outside; the larva may mine beyond this point, returning to the tunnel. When a new mine is made, as sometimes occurs, a little silk is spun over the entrance and the same tunnel-shaped exit constructed before feeding is resumed. The larva is pale yellowish white, with head and thoracic shield pale brown; a darker spot on each of the fourth and fifth abdominal segments.

The pupa (fig. 49) is enclosed in a very open irregular meshwork. The dorsal abdominal surface is less flattened than in the two preceding species, the spiracles but little produced; the head and thorax are more elaborately tuberculate than in the other species of the section; the dorsum of the mesothorax bears four rows of bead-like tubercles; there are lines of fine tubercles on the wings.

In venation the fore wing of *E. argentosa* differs from that of *madarella* in that Cu_{1b} arises opposite the origin of R_2, but R_2 and R_3 are farther apart than are R_1 and R_2, as in *madarella.* The dilated tip of the costal streak corresponds in position to the pale golden or silvery spot in the middle of the wing before apex in *E. madarella* and *E. enitescens.*

6. **COSMIOTES** Clemens

Cosmiotes Clemens, 1860. Proc. Acad. Nat. Sci. Phila., p. 8.

GENOTYPE.—*Cosmiotes illectella* Clemens, 1860.

Head smooth-scaled; labial palpi long, diverging and somewhat recurved, third segment much shorter than the second, acute; antennal pecten consisting of a few fine hairs near base of scape.

Fore wing (figs. 16, 16a, 16b) lanceolate, acute; R_4, R_5 and M_1 stalked together, R_4 out of the stalk before the forking of $R_5 + M_1$, sometimes the three veins separating close together; M_2 absent, M_3 and Cu_{1a} united; 1A + 2A without basal forking (1b simple).

Hind wing (fig. 16) one-half the width of the fore wing; acute; M_1 stalked with R_s, M_2 and M_3 absent; cell open between Cu_{1a} and $R_s + M_1$.

Hind tibiae with long hairs above, shorter hairs below; middle spurs before the middle of the segment.

Male genitalia (figs. 56, 56a, 57, 57a); lobes of the uncus widely separated, c'aw-like, apices directed inwardly, setose on the inner surfaces; socii, two small drooping papillae; gnathos, a small spined knob; harpe very long, produced into an acute spine at apex; without free arm; sacculus process long, slender, apex somewhat enlarged, concave and setose inwardly; ventral plate of anellus with two broadly diverging arms at base, deeply cleft at apex into two blunt conical setose lobes; anellus anteriorly produced into a large membranous pouch; vinculum abruptly narrowing into a long point; aedeagus long, slender, evenly tapering, curving near apex, a keel-shaped projection at base; no cornutus.

Female genitalia (figs. 103, 103a, 104, 105); seventh abdominal sternite strongly sclerotized and modified, its posterior margin with a deep median sinus, on each side of which it is produced as a thickened lobe; the margins of the sinus form the ventral anterior and lateral borders of the ostium; ductus bursae short, sclerotized through the seventh segment; inception of the ductus seminalis at the posterior end of the finely spiculate bursa copulatrix; signum a circular sclerotized patch, from which projects a pair of opposite heavy spines, with one or more smaller accessory spines.

The species of *Cosmiotes* are miners in leaves of many species of grass, and are not specific as to food plant.

The eggs, larvae and mines are very similar to those of the typical species of *Elachista* of Section II. The pupa agrees with that of *Elachista* in general structure, in the tubercles of head and mesothorax, and with the more specialized species in the produced spiracles, but may be distinguished from all pupae of that genus by the pair of backwardly directed spines on the vertex (fig. 50).

In describing *Cosmiotes,* Clemens wrote: "the subcostal nervure . . . sends from the angle of the disk a *trifid branch,* which is either forked on the costa by an exceedingly short branch before the tip, and gives rise at about its middle to a branch to the inner margin, or is trifid at its extreme tip. The median is two- or three-branched near its end." Of the hind wing he wrote: "The median is well indicated, with *two or three* short approximated branches about the middle of the inner margin."

As the type of *illectella,* the first of the three species described at that time, is not in existence, it is necessary to deduce its structure from Clemens' statements. In the fore wing, the alternative, median two-branched, is applicable to *illectella* alone, as in both of the other species described at the same time (of which the types are in existence), M_2, $M_3 + Cu_{1a}$ and Cu_{1b} of the fore wing are all present (*i.e.,* median vein three-branched). *Illectella* is thus characterized: "Median vein of hind-

wings two-branched. Apical vein trifid at tip," that is, M_3 of hind wing absent, and R_4, R_5 and M_1 of the fore wing separating close together from the common stalk (cf. fig. 16b, ♀).

The unique and characteristic genitalia, together with the different venation, warrant the removal of *Cosmiotes* from synonymy with *Elachista*, and its restriction to the species posessing those characters. In addition to the three American species, the European *stabilella* Frey and *nigrella* Haworth belong here. They form a closely related group of species of similar aspect, distinguished from one another by slight differences, best by characters of the female genitalia.

Key to the Species of Cosmiotes

Males

1. Face creamy white, vertex or even entire head sometimes creamy white; lobes of anellus with a few strong setae ..... (3) **scopulicola**
   Face not creamy white, fuscous, or if pale, silvery or grayish, vertex and occiput fuscous or irrorated gray 2
2. Setae of anellus lobes numerous, fine; wing expanse 8.5 mm. ..... (2) **herbigrada**
   Setae of anellus lobes few, but fine; wing expanse under 8 mm., usually 6 to 7.5 mm. ..... (1) **illectella**

Females

1. Face creamy white, vertex or even entire head sometimes creamy white; ductus bursae evenly tapering from ostium; ostium not spinulate; one pair of accessory spines of signum half the length of the major pair ..... (3) **scopulicola**
   Face fuscous, or if pale, silvery or grayish white, vertex and occiput fuscous or irrorated gray; ductus bursae not evenly tapering, swollen in segment 7; ostium spinulate; accessory spines of signum small or absent 2
2. Ostium and sclerotized portion of ductus bursae densely spinulate; sinus of the seventh segment less deep than in *herbigrada;* wing expanse 6.5 to 7 mm., rarely 8 mm. ..... (1) **illectella**
   Ostium and ductus bursae less densely spinulate; sinus of seventh segment deep; wing expanse 9.5 mm. ..... (2) **herbigrada**

(1) **Cosmiotes illectella** Clemens (Figs. 16, 16a, 16b, 50, 103, 103a.)

1860. *Cosmiotes illectella* Clemens, Proc. Acad. Nat. Sci. Phila., p. 9. Type locality, Pennsylvania (? Easton).

1872. *Elachista* (*Cosmiotes*) *illectella* Stainton, Tineina of No. Amer., p. 98.

1903. *Elachista illicitella* Dyar, Bull. 52, U. S. N. M., p. 536 (misspelling).

1923. *Aphelosetia illectella* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 223.

1860. *Elachista praematurella* Clemens, Proc. Acad. Nat. Sci. Phila., p. 172. Type ♂, Pennsylvania [A. N. S. P., Type No. 7398]. (New synonymy.)

1872. *Elachista praematurella* Stainton, Tineina of No. Amer., p. 133.

1874. *Elachista praematurella* Chambers, Canad. Ent., VI, pp. 76–77.

1903. *Elachista praematurella* Busck, Proc. Ent. Soc. Wash., v, 203.

1914. *Elachista praematurella* Braun, Ent. News. XXV, 114.

1922. *Elachista praematurella* Braun, Canad. Ent., LIV, 94.

1923. *Aphelosetia praematurella* Forbes, Mem. 68, Cornell Univ. Agric. Exp. Sta., p. 223.

1876. *Elachista cristatella* Chambers, Canad. Ent., VIII, 172. Type ♂, Kentucky [M. C. Z.]. (New synonymy.)

1880. *Elachista albapalpella* Chambers, Journ. Cin. Soc. Nat. Hist., III, p. 294. Type ♀, Amherst, Massachusetts [U. S. N. M., Type No. 1035]. (New synonymy.)

Head fuscous, irrorated with dark gray, face sometimes paler, more or less silvery, but scales usually tipped with dark gray; palpi fuscous, paler and sometimes whitish above, a black spot at base of third segment above; antennae dark fuscous with narrow paler annulations. Fore wing, male: fuscous, densely dusted, the paler bases of the scales grayish white; just before middle a slightly oblique irregular narrow fascia (in the form described as *cristatella,* much reduced and indicated only by a broken line); posterior to the fascia below the fold an elongate patch of black slightly raised scales, not contrasting in the darkest specimens; at two-thirds, a white costal and an opposite dorsal spot, occasionally obsolete, a few black scales sometimes separating their apices; usually a few white scales at extreme apex; cilia fuscous, whitish around apex, the marginal scales projecting into them conspicuously black-tipped. Fore wing, female: darker than in the male, more evenly dark brown or black, but when irrorated, paler before the fascia, especially in the late fall and early spring generations; fascia broad, silvery white, dorsal and costal spots silvery white, never reduced in size; cilia fuscous, white around apex, the black-tipped marginal scales white at base around apex, and forming a more or less conspicuous white transverse mark in the cilia. Hind wings and cilia fuscous, darker in the female. Legs gray, hind tibiae with a white band before middle and at apex. Abdomen fuscous, genital segments of male clothed with long yellowish white hairs.

Alar expanse: 6 to 7.5 mm., rarely 8 mm.

Male genitalia: as in *scopulicola* (figs. 56, 56a), except that the setae of the anellus lobes are somewhat shorter and finer.

Female genitalia (figs. 103, 103a): ostium and sclerotized portion of ductus bursae densely spinulate, ductus bursae as wide as the ostium through most of

segment 7, then abruptly narrowing at the anterior margin of segment 7; signum a pair of opposite large spines, accessory spines absent or minute.

More than a hundred specimens of both sexes have been examined. *C. illectella* is represented in collections from Ontario, Massachusetts, New York, New Jersey, Pennsylvania, Tennessee, Kentucky, Ohio and Michigan (in both the Lower and Upper Peninsula) and probably occurs throughout the eastern United States and Canada.

The mines are found on leaves of many species of grass, among them *Poa pratensis* (Kentucky Blue Grass), *Poa* spp., *Agrostis* spp., *Hystrix* sp., *Elymus* sp., *Oryzopsis* sp., *Bromus* sp., and *Phleum* (timothy). Mining larvae may be found almost throughout the year, even in the winter, and produce imagoes within a few weeks. The mine starts as a fine line, gradually increases in breadth and on the narrow-leaved grasses, occupies the width of the blade. It is usually whitish, with parenchyma all consumed, and is about equally visible from either leaf surface.

The larva varies in color to some extent with the food plant, but is usually greenish yellow, with the prothoracic shield marked posteriorly with a transverse brownish bar on either side of the mid-line, and fainter longitudinal markings down each side of the mid-line. Pupation takes place beneath a dense white meshwork of irregularly placed silk strands. The pupa (fig. 50) is characteristic of the genus, with the two backwardly pointing spines of the vertex; specifically it is distinguished from that of *scopulicola* by the two small tubercles of the prothorax.

The marked sexual dimorphism is responsible in part for the synonyms. The description of *illectella* applies to the female; in the type, apparently, veins R_4, R_5 and M_1 separated from their stalk close together, a condition occurring rarely in the female (fig. 16b); the more usual condition is that shown in figure 16. In the male (fig. 16a), the point of separation of R_4 is usually farther basad than in the female. The type of *praematurella* is a male with the fascia and costal and dorsal spots distinct, and a few white scales projecting from the extreme apex of the wing. *Albapalpella* by genitalia of the female type is a synonym; *cristatella* is a pale irrorated male, with obsolescent white marks and conspicuous patch of black raised scales near dorsal margin beyond the fascia.

(2) **Cosmiotes herbigrada** (Braun) (Figs. 57, 57a, 104.)

1925. *Elachista herbigrada* Braun, Trans. Am. Ent. Soc., LI, p. 211. Type ♀, Providence Lake, Wasatch Mountains, Utah, altitude 8600 feet [A. F. B. Coll.].

Face pale, yellowish tinged, with some of the scales gray-tipped; head above pale grayish, the scales more or less broadly tipped with dark gray; palpi fuscous, whitish above, the third segment black at extreme base, irregularly fuscous-dotted beneath; antennae gray, with narrow paler annulations. Thorax and fore wings fuscous, irrorated, the bases of the scales whitish; more evenly dark in the female. Fore wings narrow elongate; a whitish spot at base of dorsum in female; a white fascia before middle a little oblique, broadest in the female; at two-thirds, a pair of opposite costal and dorsal spots, joining in the female to form a broad fascia, constricted in the middle; in the male, one line of darker scales extends through the cell, crossing the fascia, and a second line below the fold forms a black dash beyond the fascia. Cilia whitish at apex, elsewhere fuscous; a few marginal scales only at extreme apex white with black tips. Hind wings and cilia pale gray. Hind tibiae gray, with the apex white and a broad white median band including the spurs. Abdomen fuscous, the hairs clothing the genital segments pale.

Alar expanse: 8.5 mm. (♂), 9.5 mm. (♀).

Male genitalia (figs. 57, 57a): setae of anellus lobes numerous and very fine; vinculum more abruptly narrowing and the produced point more rounded than in the other two species.

Female genitalia (fig. 104): ostium spinulate, but spinules fewer and more minute than in *illectella;* ductus bursae swollen in segment 7, and abruptly narrowing at anterior margin of segment 7; sinus of the seventh segment deep; signum with several minute accessory spines.

Specimens examined: 1 ♂, 1 ♀.

UTAH: Providence Lake, Wasatch Mountains, Cache County, altitude 8600 feet, ♀ type, June 24, 1924 [A. F. B. Coll.].

COLORADO: Rocky Mountain National Park, Hidden Valley, 1 ♂, August 12, 1929 [A. F. B. Coll.].

Food plant and early stages unknown.

This species is very close to *C. illectella;* the larger size, the narrower wings, and the tendency toward the arrangement of dark-tipped scales in longitudinal lines in the male, and the slight differences noted in the genitalia will aid in separating the two species.

A specimen from Colorado, foot of Gray's Peak, altitude about 11,200 feet, doubtfully referred by Chambers to *Elachista praematurella* (Bull. U. S. Geol. and Geogr. Surv. of Terr., III, 143, 1877) probably belongs to this species.

(3) **Cosmiotes scopulicola** new species (Figs. 56, 56a, 105.)

Face creamy white, the white usually extending onto the vertex and often over the entire head, except for a few dark-tipped scales; palpi conspicuously white above, with a minute black spot at base of third segment, second segment fuscous beneath, third segment dotted with fuscous beneath; antennae gray with narrow pale annulations. Thorax and fore wings dark gray, irrorated, the bases of the scales white; the male usually paler and more conspicuously irrorated than the female, the ground color in the female often a little paler before the fascia. Tegulae and a small spot at base of dorsum often white. Before middle, a narrow white fascia (seldom narrower in the male), and at two-thirds a pair of opposite costal and dorsal spots; black dash beyond fascia not conspicuous except in the palest specimens. Cilia white except toward dorsum, the black-tipped marginal scales white at base at tip of wing, elsewhere gray, their black tips forming a conspicuous line through the cilia. Hind wings gray, irrorated. Hind tibiae blackish, with apex and a broad band near base white. Abdomen mixed fuscous and white in the male, with pale yellow hairs clothing the genital segments, blackish in the female.

Alar expanse: 6 to 8 mm.

Male genitalia (figs. 56, 56a): setae of anellus lobes few and heavy.

Female genitalia (fig. 105): ostium not spinulate, sclerotized portion of ductus bursae gradually tapering from ostium to anterior margin of segment 7, not swollen in segment 7; one pair of accessory spines of signum half or more than half as long as the major pair.

Type.— ♂, Huron Mountains, Michigan, along bluffs of Lake Superior, imago August 24, 1943, under rearing record B.2051 [A. F. B. Coll.].

Allotype.— ♀, same data as the type, except imago August 17, 1943 [A. F. B. Coll.].

Paratypes.—16 ♂, 4 ♀, under rearing record B.2051, with dates of emergence from August 9 to August 25; 7 ♂, 6 ♀, same locality, under rearing record B.2056, with dates of emergence from August 10 to August 28; 2 ♂, same locality, under rearing record B.2057, imagoes August 15, August 17 [A. F. B. Coll.].

The series under B.2051 was reared from *Poa* sp., that under B.2056 from *Agrostis* sp.; the two under B.2057 from an unidentified grass. The mine gradually widens from the early thread-like mine, with parenchyma entirely consumed. The mines on *Poa* sp. were white, those on *Agrostis* sp. somewhat brownish. Larva with head black, prothoracic shield with only the center pale, and the body yellowish or green, depending on the food plant. Pupation takes place under a dense

silk meshwork. The pupa is scarcely distinguishable from that of *illectella,* except that the pair of tubercles of the prothorax of that species are lacking in *scopulicola.*

C. scopulicola was reared only from grasses growing along the bluffs of Lake Superior, a more extreme habitat with accompanying more northern vegetation than the forest away from the lake border. All specimens reared on grasses in the forest are *C. illectella.*

The creamy white of face and vertex and the clearer black and white wings of *scopulicola,* with white bases of scales may be used to differentiate this species from *illectella,* but the only certain means of identification is the smooth ostium and the narrow, evenly tapering ductus bursae in the seventh segment in the female.

7. **DICRANOCTETES** Braun

Dicranoctetes Braun, 1918. Ent. News, XXIX, p. 250.

GENOTYPE.—*Dicranoctetes angularis* Braun, 1918 [= *Elachista brachyelytrifoliella* Clemens, 1864].

Donacivola Busck, 1934. Ent. Amer., XIII, p. 169.

GENOTYPE.—*Donacivola saccharella* Busck, 1934.

Dicranoctetes Braun, 1935. Trans. Am. Ent. Soc., LXI, p. 47.

Head smooth, face flattened, strongly retreating; eyes small, concealed from above and partially covered by the appressed scales of the face; maxillary palpi absent; labial palpi very long, slightly curved, divergent, smooth-scaled, second segment twice the length of the acute third segment; tongue well developed, scaled only at extreme base; antennae two-thirds (♂) to three-fourths (♀) the length of the fore wing, with short fine ciliations in the male, scape not enlarged, no pecten.

Fore wing (fig. 12) ovate-lanceolate, apex produced, acuminate and upturned; cell narrow, R_1 from near middle of cell, cell open between R_2 and R_3, R_3 from apex of cell at base of stalk of R_4, R_5, M_1, M_2, and $M_3 + Cu_{1a}$, R_4 and R_5 out of M_1, M_2 and $M_3 + Cu_{1a}$ out of M_1 before R_4, $M_3 + Cu_{1a}$ from near base of stalk; Cu_{1b} strong, distant; Cu_2 weak; $1A + 2A$ not forked at base (1b simple).

Hind wing (fig. 12) half as broad as the fore wing, lanceolate, pointed; $Sc + R_1$ reaching costa before middle, R_s and M_1 long stalked, M_2 and M_3 absent, cell open between Cu_{1a} and $R_s + M_1$; Cu_2 and the anal veins obsolescent.

Posterior tibiae with fine stiff hairs above and below; middle spurs before the middle.

Male genitalia (figs. 59, 59a): uncus lobes widely separated, densely setose; socii vestigial; gnathos a spined knob; cucullus of harpe with long decumbent

setae, sacculus process elongate, very closely appressed, concave at tip, setose on the concave inner surface; anellus produced into two elongate papillae bearing tufted hairs; vinculum with a short blunt anterior projection; aedeagus a short straight cylinder, no cornutus.

Female genitalia (fig. 106): genital plate reduced to a narrow marginal band with diverging arms; ductus bursae short, broadly funnel-shaped and sclerotized near the wide ostium; a short membranous contracted section separates this dilated part from a short sclerotized section just anterior to which the ductus seminalis arises; bursa copulatrix elongate oval, obscurely bilobed, spiculate; signum an elongate, slightly bent, dentate band.

Dicranoctetes is the most specialized of the grass or sedge feeding genera. The two known species of the genus are miners in leaves of Gramineae; the Cuban species (*saccharella*) a miner of sugar cane. The American species shows a preference for species of *Muhlenbergia*.

The egg of *Dicranoctetes* is similar to that of *Elachista,* elongate ellipsoidal, flattened, with many longitudinal parallel ridges. In the more specialized larva, the head capsule is very elongate, flattened, with the ventral pair of ocelli as well as the three dorsal ocelli crowded together and in contact; the first two thoracic segments very broad, twice the breadth of the head, the third thoracic narrower and from thence the body tapering; the incisures so deep that the segments appear almost moniliform; setae long. Prothoracic shield circular, weakly sclerotized and contrastingly darkened only posteriorly; prothoracic legs absent, meso- and metathoracic legs well developed; abdominal prolegs on segments 3, 4, 5, 6 and 10, crochets on all except the anal prolegs arranged in a posterior uniordinal transverse row, on the anal prolegs in an anterior half circle; suranal plate not differentiated.

The pupa (fig. 51, ♀) is an extreme specialization along the line indicated in *Elachista* and *Cosmiotes*. The body is flattened, abdomen slightly concave dorsally and the lateral ridges are produced into long curved acute spines; the posterior forks of the abdominal spines bear the spiracles at their summits; a pair of long acute spines projects forward from the vertex; similar spines arm the sides of the head and the mesothorax. The appendages are fused to one another and to the body, the wings extending to the caudal margin of segment 7. The spining of the ninth and tenth segments varies with the sex; in the male the anterior pair of spines is reduced to blunt projections.

(1) **Dicranoctetes brachyelytrifoliella** (Clemens) (Figs. 12, 51, 59, 59a, 106.)

1864. *Elachista brachyelytrifoliella* Clemens, Proc. Acad. Nat. Sci. Phila., p. 425. Type, Clemens No. 218, Easton, Pennsylvania [A. N. S. P., Type No. 7399].

1872. *Elachista brachyelytrifoliella* Stainton, Tin. No. Amer., p. 248.

1903. *Elachista brachyelytrifoliella* Busck, Proc. Ent. Soc. Wash., v, 217.

1923. *Aphelosetia brachyelytrifoliella* Forbes, Mem. 68, Cornell Univ. Agric. Exper. Sta., p. 221.

1918. *Dicranoctetes angularis* Braun, Ent. News, XXIX, 251. Type ♂, Mountain Lake Park, Maryland [A. F. B. Coll.]. (New synonymy.)

1935. *Dicranoctetes angularis* Braun, Trans. Am. Ent. Soc., LXI, 47.

Face silvery, with faint golden luster; head above dull gray; palpi white, some fuscous shading on the second segment beneath, third segment with base, a spot beyond middle and tip black; antennae gray. Thorax and basal third of fore wing gray, shading abruptly outwardly to dark blackish brown. From near base of costa a white line follows the costal margin, widening at one-fourth and diverging from the costa as a short very oblique streak ending just within the dark brown portion of the wing; just beyond the middle, a pair of more or less triangular oblique silvery white spots, their apices sometimes nearly meeting in the middle of the wing; a large black apical spot partially projecting into the cilia. Costal and apical cilia white, margined basally by black scales, and divided by two perpendicular black lines in the costal cilia, and a longer black streak at apex extending outwardly from the apical spot. Cilia below the apex gray and marked with two parallel black lines, formed by the tips of projecting scales, and a third fine silvery line, formed by the tips of the outermost row of scales. Hind wings and cilia dark brownish gray. Legs silvery white, hairs on upper side of posterior tibiae dark gray. Abdomen dark fuscous, silvery beneath, except segments 7 and 8 of the female wholly black.

Alar expanse: 5.5 to 7.5 mm.

Male genitalia (figs. 59, 59a); female genitalia (fig. 106): described under the generic characterization.

Specimens examined: 10 ♂, 13 ♀; type (without abdomen).

PENNSYLVANIA: Easton, type [A. N. S. P.].

MARYLAND: Mountain Lake Park, ♂, July 26, 1906 [type of *angularis* Braun, A. F. B. Coll.].

VIRGINIA: White Oak Canyon, Shenandoah National Park, 1 ♂, 1 ♀, under rearing record B. 1661, with dates of emergence August 12 and 13, 1938 [A. F. B. Coll.]; Falls Church, 1 ♂, April 27, 1915, C. H. Coll., [U. S. N. M.].

KENTUCKY: Carter Caves, Carter County, 2 ♀, under rearing record B.1427, imagoes April 11 and May 11, 1937 [A. F. B. Coll. and U. S. N. M.]; Mammoth Cave National Park, 4 ♂, 6 ♀, under rearing records B.1844 and B.1845, with dates of emergence September 28, 1940 (1 ♂) and April 16 to May 28,

1941 [A. F. B. Coll.]; 2 ♂, 2 ♀, under rearing record B.1842, imagoes April 16 to April 20, 1941 [A. F. B. Coll.].

ARKANSAS: Carroll County, 1 ♂ under rearing record B.1634, imago July 22, 1938 [A. F. B. Coll.].

MICHIGAN: Cecil Bay, Emmet County, 2 ♀, under rearing record B.1987, with dates of emergence March 30 and April 2, 1943 [A. F. B. Coll.].

A comparison of reared material of *D. angularis* Braun with Clemens' type of *brachyelytrifoliella* establishes the synonymy.

Clemens' type was reared on *Brachyelytrum aristatum* (= *erectum* (Schreb.) Beauv.). The species however shows a decided preference for *Muhlenbergia* spp., and all of my reared specimens except the two under rearing record B.1842 were miners of leaves of various species of *Muhlenbergia*. The mines may be found from early July to October. A fine linear mine an inch or two in length, often following the margin of the leaf, precedes the elongate blotch, which may be two inches or more long. At first the parenchyma is eaten in patches, later it is completely consumed and the mine is conspicuously white above, but greener below. Occasionally a second mine is made, distinguished from the original by the absence of a linear part. Pupation takes place in a crevice beneath two layers of silk, the inner consisting of a sheet of criss-cross threads close to the pupa, the outer layer more open, with the threads all placed transversely. The extraordinary pupa (fig. 51) has been described under the generic heading.

The females under B.1842 were reared from mines on *Uniola latifolia* Michx. The mines on this grass were greener than those on *Muhlenbergia*, with the parenchyma left along the side of each vein.

D. brachyelytrifoliella is a widely distributed and apparently not a rare species, as the mines often occur in considerable numbers and are conspicuous because of their whiteness. From the only other species of the genus, *saccharella* Busck from Cuba, it is distinguished by the sharply defined white costal streak from near base, which in that species is merely indicated by a paler shade adjacent to the darker and irrorated outer two-thirds of the wing. In genitalia the two species are scarcely distinguishable; in the male genitalia slide of *D. saccharella* in the United States National Museum the sacculus process is so closely appressed to the harpe as to appear fused with it nearly to its tip.

List of Genera and Species

(*Synonyms in italics*)

1. Coelopoeta Walsingham
    1. glutinosi Walsingham
    baldella Barnes and Busck
2. Onceroptila new genus
    1. cygnodiella (Busck)
    2. eremonoma new species
3. Stephensia Stainton
    1. cunilae Braun
4. Hemiprosopa new genus
    Eurynome Chambers of 1877, not of 1875
    1. albella (Chambers)
5. Elachista Treitschke
    Aphelosetia Stephens
    Poeciloptilia H. S. (not Hbn.)
    Phigalia Chambers
    Hecista Wallengren
    Aphigalia Dyar
    1. epimicta new species
    orestella Braun (not Busck)
    2. symmorpha new species
    3. orestella Busck
    4. synopla new species
    orestella Braun (not Busck)
    5. spatiosa new species
    6. aurocristata Braun
    7. controversa Braun
    8. albella (Chambers) (as Phigalia albella)
    9. adempta nom. nov.
    albella (Chambers) (as *Laverna albella*)
    10. griseicornis Meyrick
    11. acenteta new species
    12. hololeuca new species
    13. purissima new species
    14. lamina new species
    15. sincera Braun
    16. parvipulvella Chambers
    17. coniophora new species
    18. hiberna new species
    19. patriodoxa Meyrick

20. irrorata Braun
    philopatris Meyrick
21. fuliginea new species
22. oxytypa new species
23. pusilla Frey and Boll
24. unifasciella Chambers
25. maculoscella (Clemens)
26. excelsicola new species
27. stramineola Braun
28. leucofrons Braun
29. albicapitella Engel
30. sylvestris Braun
31. nitidiuscula new species
32. cucullata Braun
33. agilis Braun
34. leucosticta new species
35. texanica Frey and Boll
36. maritimella McDunnough
37. staintonella Chambers
38. cana Braun
39. amideta new species
40. inaudita Braun
41. tanyopis Meyrick
42. salinaris Braun
43. praelineata Braun
44. solitaria Braun
45. radiantella Braun
46. madarella (Clemens)
47. enitescens Braun
48. argentosa Braun

6. Cosmiotes Clemens
    1. illectella Clemens
       illicitella Dyar
       praematurella Clemens
       cristatella Chambers
       albapalpella Chambers
    2. herbigrada (Braun)
    3. scopulicola new species
7. Dicranoctetes Braun
   Donacivola Busck
    1. brachyelytrifoliella (Clemens)
       angularis Braun

Explanation of Plates

Plate I

Fig. 1.—*Coelopoeta glutinosi* Walsingham, venation. San Bernardino County, Calif.

Fig. 2.—*Coelopoeta glutinosi* Walsingham, abdominal spines (modified setae). San Bernardino County, Calif.

Fig. 3.—*Elachista madarella* (Clemens), lateral view of head, male. Cincinnati, Ohio.

Fig. 4.—*Hemiprosopa albella* (Chambers), lateral view of head, male. Saskatoon, Saskatchewan.

Fig. 5.—*Hemiprosopa albella* (Chambers), venation. Saskatoon, Saskatchewan.

Fig. 6.—*Elachista epimicta* new species, lateral view of head, male. Cincinnati, Ohio (paratype).

Fig. 7.—*Elachista albicapitella* Engel, lateral view of head, male. Cincinnati, Ohio.

Fig. 8.—*Elachista radiantella* Braun, lateral view of head, male. Clermont County, Ohio.

Plate II

Venation

Fig. 9.—*Onceroptila cygnodiella* (Busck), female. Victoria, B. C.

Fig. 10.—*Stephensia brunnichiella* (Linn.), male.

Fig. 11.—*Stephensia cunilae* Braun, female. Adams County, Ohio (paratype).

Fig. 12.—*Dicranoctetes brachyelytrifoliella* (Clemens), female. Mammoth Cave, Ky.

Fig. 13.—*Elachista patriodoxa* Meyrick, type, female. Muskoka, Ontario.

Fig. 14.—*Elachista hiberna* new species, female. Pike County, Ohio (paratype).

Fig. 15.—*Elachista epimicta* new species, male. Cincinnati, Ohio (paratype).

Fig. 16.—*Cosmiotes illectella* Clemens, female; 16a, tip of fore wing, male; 16b, tip of fore wing, female, showing "apical vein trifid at tip." All from Cincinnati, Ohio.

Plate III

Fig. 17.—*Elachista leucofrons* Braun, venation. Cincinnati, Ohio.

Fig. 18.—*Elachista madarella* (Clemens), venation. Cincinnati, Ohio.

Fig. 19.—*Elachista irrorata* Braun, venation. Cincinnati, Ohio.

Fig. 20.—*Elachista radiantella* Braun, venation. Clermont County, Ohio.
Fig. 21.—*Elachista albicapitella* Engel, seta map of larva. Cincinnati, Ohio.
Fig. 22.—*Elachista hiberna* new species, dorsal view of larva; 22a, lateral view of larva (× 10). Pike County, Ohio.
Fig. 23.—*Elachista radiantella* Braun, dorsal view of head and thoracic segments of larva (× 15). Clermont County, Ohio.
Fig. 24.—*Stephensia cunilae* Braun, egg, greatly magnified. Adams County, Ohio.
Fig. 25.—*Elachista hiberna* new species, egg, greatly magnified. Pike County, Ohio.
Fig. 26.—*Elachista solitaria* Braun, egg, greatly magnified. Adams County, Ohio.

Plate IV

Fig. 27.—*Elachista argentosa* Braun, mine on *Carex* (× 2). Cincinnati, Ohio.
Fig. 28.—*Elachista sylvestris* Braun, mine on *Poa sylvestris* (natural size). Cincinnati, Ohio.
Fig. 29.—*Elachista solitaria* Braun, mine on *Panicum clandestinum* (natural size). Adams County, Ohio.
Fig. 30.—*Elachista praelineata* Braun, mine on *Hystrix* (natural size). The figure shows the mine as it appears when viewed on the plant, *i.e.* lower epidermis up. Cincinnati, Ohio.
Fig. 31.—*Elachista enitescens* Braun, cocoon on *Scirpus* (× 5). Cincinnati, Ohio.
Fig. 32.—*Elachista madarella* (Clemens), mine on *Carex* (¾ natural size). Cincinnati, Ohio.

Plate V

Pupae

All figures × 15 unless otherwise stated

Fig. 33.—*Stephensia cunilae* Braun (× 20). Adams County, Ohio.
Fig. 34.—*Elachista hiberna* new species. Pike County, Ohio.
Fig. 35.—*Elachista sylvestris* Braun. Cincinnati, Ohio.
Fig. 36.—*Elachista leucofrons* Braun. Cincinnati, Ohio.
Fig. 37.—*Elachista irrorata* Braun; 37a, cross section through middle of third abdominal segment. Cincinnati, Ohio.
Fig. 38.—*Elachista albicapitella* Engel. Cincinnati, Ohio.
Fig. 39.—*Elachista epimicta* new species. Cincinnati, Ohio.

Plate VI

Pupae

All figures × 15 unless otherwise stated

Fig. 40.—*Elachista cucullata* Braun, dorsal view; 40a, cross section through middle of fourth abdominal segment. Cincinnati, Ohio.
Fig. 41.—*Elachista cucullata* Braun, lateral view. Cincinnati, Ohio.
Fig. 42.—*Elachista radiantella* Braun (× 20). Clermont County, Ohio.
Fig. 43.—*Elachista inaudita* Braun, pupal skin of type. Sparrow Lake, Ontario.
Fig. 44.—*Elachista praelineata* Braun (× 20). Cincinnati, Ohio.
Fig. 45.—*Elachista salinaris* Braun, pupal skin of type. Bear River Bay, Great Salt Lake, Utah.

Plate VII

Pupae

Fig. 46.—*Elachista solitaria* Braun, dorsal view of pupal skin of type (× 20); 46a, ventral view of the same. Powell County, Ky.
Fig. 47.—*Elachista enitescens* Braun (× 15). Cincinnati, Ohio.
Fig. 48.—*Elachista madarella* (Clemens) (× 15). Cincinnati, Ohio.
Fig. 49.—*Elachista argentosa* Braun (× 20). Cincinnati, Ohio.
Fig. 50.—*Cosmiotes illectella* Clemens (× 20). Cincinnati, Ohio.
Fig. 51.—*Dicranoctetes brachycelytrifoliella* (Clemens), female (× 20). Cecil Bay, Mich.

Plate VIII

Male Genitalia

Fig. 52.—*Stephensia cunilae* Braun, paratype, ventral view; 52a, aedeagus. Adams County, Ohio.
Fig. 53.—*Onceroptila eremonoma* new species, type, ventral view; 53a, aedeagus. Eureka, Utah.
Fig. 54.—*Onceroptila cygnodiella* (Busck), ventral view; 54a, aedeagus. Victoria, B. C.
Fig. 55.—*Coelopoeta glutinosi* Walsingham, lateral view, with left harpe removed; 55a, ventral view of anellus, vinculum and bases of harpes; 55b, aedeagus. San Bernardino County, Calif.

Plate IX

Male Genitalia (most of left harpe omitted)

Fig. 56.—*Cosmiotes scopulicola* new species, type, ventral view; 56a, aedeagus, dorsal view. Huron Mts., Mich.
Fig. 57.—*Cosmiotes herbigrada* (Braun), ventral view; 57a, aedeagus, lateral view. Rocky Mountain National Park, Colo.
Fig. 58.—*Hemiprosopa albella* (Chambers), ventral view; 58a, aedeagus. Association Camp, Colo.
Fig. 59.—*Dicranoctetes brachyelytrifoliella* (Clemens), ventral view; 59a, aedeagus. Mammoth Cave, Ky.

Plate X

Male Genitalia (most of left harpe omitted)

Fig. 60.—*Elachista symmorpha* new species, type, ventral view with left sacculus process removed; 60a, aedeagus. Monache Meadows, Tulare County, Calif.
Fig. 61.—*Elachista epimicta* new species, paratype, ventral view; 61a, aedeagus. Cincinnati, Ohio.
Fig. 62.—*Elachista orestella* Busck, ventral view with left sacculus process removed; 62a, aedeagus. Cohasset, Mass.

Plate XI

Male Genitalia (most of left harpe omitted)

Fig. 63.—*Elachista synopla* new species, type, ventral view. Logan Canyon, Cache County, Utah.
Fig. 64.—*Elachista coniophora* new species, paratype, ventral view; 64a, aedeagus. San Diego, Calif.
Fig. 65.—*Elachista controversa* Braun, paratype, ventral view. Monache Meadows, Tulare County, Calif.
Fig. 66.—*Elachista aurocristata* Braun, paratype, ventral view. Glacier National Park, Montana.

Plate XII

Male Genitalia (most of left harpe omitted)

Fig. 67.—*Elachista acenteta* new species, type, ventral view with left sacculus process removed; 67a, aedeagus. Parrsboro, Nova Scotia.
Fig. 68.—*Elachista purissima* new species, type, ventral view; 68a, aedeagus. Summerland, B. C.
Fig. 69.—*Elachista griseicornis* Meyrick, ventral view. Blackburn, Ontario.

Plate XIII

Male Genitalia (most of left harpe omitted)

Fig. 70.—*Elachista albella* (Chambers), ventral view. Lethbridge, Alberta.
Fig. 71.—*Elachista adempta* nom. nov., ventral view; 71a, aedeagus. Stockton, Utah.
Fig. 72.—*Elachista hololeuca* new species, type, ventral view; 72a, aedeagus. Penticton, B. C.

Plate XIV

Male and Female Genitalia

Fig. 73.—*Elachista hiberna* new species, paratype, ventral view of female genitalia. Pike County, Ohio.
Fig. 74.—*Elachista hiberna* new species, paratype, ventral view of male genitalia. Cascapedia, Quebec.
Fig. 75.—*Elachista patriodoxa* Meyrick, ventral view of male genitalia; 75a, aedeagus. Trenton, Ontario.
Fig. 76.—*Elachista patriodoxa* Meyrick, type, ventral view of female genitalia; 76a, one signum greatly enlarged. Muskoka, Ontario.

Plate XV

Male Genitalia

Fig. 77.—*Elachista irrorata* Braun, ventral view, left harpe omitted; 77a, detail of apex of aedeagus. Cincinnati, Ohio.
Fig. 78.—*Elachista nitidiuscula* new species, type, ventral view, left harpe omitted. Cincinnati, Ohio.
Fig. 79.—*Elachista fuliginea* new species, type, ventral view, left harpe omitted; 79a, aedeagus. Martha's Vineyard, Mass.
Fig. 80.—*Elachista oxytypa* new species, paratype, right harpe; 80a, aedeagus. Bradore Bay, Quebec.
Fig. 81.—*Elachista sylvestris* Braun, paratype, ventral view, left harpe omitted. Cincinnati, Ohio.

Plate XVI

Male Genitalia (most of left harpe omitted)

Fig. 82.—*Elachista excelsicola* new species, type, ventral view; 82a, aedeagus. Mt. Washington, New Hampshire.
Fig. 83.—*Elachista stramineola* Braun, ventral view. Victoria, B. C.
Fig. 84.—*Elachista leucofrons* Braun, ventral view. Cincinnati, Ohio.

Plate XVII

Male Genitalia (most of left harpe omitted)

Fig. 85.—*Elachista maritimella* McDunnough, paratype, ventral view; 85a, aedeagus. Bathurst, New Brunswick.
Fig. 86.—*Elachista albicapitella* Engel, ventral view; 86a, tip of vinculum viewed laterally. Cincinnati, Ohio.
Fig. 87.—*Elachista cana* Braun, paratype, ventral view. Toland, Colo.
Fig. 88.—*Elachista amideta* new species, paratype, ventral view. Ottawa, Ontario.

Plate XVIII

Male Genitalia (most of left harpe omitted)

Fig. 89.—*Elachista leucosticta* new species, type, ventral view; 89a, aedeagus. Constance Bay, Ontario.
Fig. 90.—*Elachista cucullata* Braun, paratype, ventral view with left sacculus process removed to show the strongly sclerotized and thickened lateral margins of the ventral plate of the anellus; 90a, aedeagus. Cincinnati, Ohio.
Fig. 91.—*Elachista tanyopis* Meyrick, ventral view. Bobcaygeon, Ontario.
Fig. 92.—*Elachista salinaris* Braun, paratype, ventral plate of anellus. Bear River Bay, Great Salt Lake, Utah.
Fig. 93.—*Elachista agilis* Braun, paratype, ventral view. Glacier National Park, Montana.

Plate XIX

Male Genitalia (most of left harpe omitted)

Fig. 94.—*Elachista argentosa* Braun, ventral view; 94a, aedeagus. Cincinnati, Ohio.
Fig. 95.—*Elachista madarella* (Clemens), ventral view; 95a, aedeagus. Cincinnati, Ohio.
Fig. 96.—*Elachista enitescens* Braun, paratype, ventral view; 96a, aedeagus. Cincinnati, Ohio.
Fig. 97.—*Elachista solitaria* Braun, ventral view; 97a, aedeagus. Powell County, Ky.
Fig. 98.—*Elachista radiantella* Braun, ventral view; 98a, aedeagus. Clermont County, Ohio.
Fig. 99.—*Elachista praelineata* Braun, paratype, ventral view; 99a, aedeagus. Cincinnati, Ohio.

Plate XX

Female Genitalia

Fig. 100.—*Onceroptila cygnodiella* (Busck), ventral view. Wawawai, Wash.
Fig. 101.—*Coelopoeta glutinosi* Walsingham, ventral view. San Bernardino County, Calif.
Fig. 102.—*Stephensia cunilae* Braun, paratype, ventral view; *a*, signum. Adams County, Ohio.
Fig. 103.—*Cosmiotes illectella* Clemens, ventral view, with ovipositor and bursa copulatrix omitted; 103a, signum. Cincinnati, Ohio.
Fig. 104.—*Cosmiotes herbigrada* (Braun), type, ventral view. Cache County, Utah.
Fig. 105.—*Cosmiotes scopulicola* new species, allotype, ventral view, with ovipositor omitted. Huron Mts., Mich.
Fig. 106.—*Dicranoctetes brachyelytrifoliella* (Clemens), ventral view. Mammoth Cave, Ky.

Plate XXI

Female Genitalia

Fig. 107.—*Elachista epimicta* new species, allotype, ventral view with ovipositor omitted. Cincinnati, Ohio.
Fig. 108.—*Elachista aurocristata* Braun, paratype, lateral view. Glacier National Park, Montana.
Fig. 109.—*Elachista spatiosa* new species, type, ventral view. Loma Linda, Calif.
Fig. 110.—*Elachista lamina* new species, paratype, latero-ventral view, bursa copulatrix omitted. Peachland, B. C.
Fig. 111.—*Elachista orestella* Busck, ventral view; 111a, greatly enlarged section of the ductus bursae to show the dentate outer surface. Westmount, Quebec.

Plate XXII

Female Genitalia

Fig. 112.—*Elachista purissima* new species, allotype, ventral view with ovipositor omitted. Summerland, B. C.
Fig. 113.—*Elachista hololeuca* new species, allotype, ventral view with ovipositor omitted. Penticton, B. C.
Fig. 114.—*Elachista acenteta* new species, allotype, ventral view. Parrsboro, Nova Scotia.
Fig. 115.—*Elachista griseicornis* Meyrick, ventral view with ovipositor omitted. S. March, Ontario.
Fig. 116.—*Elachista sincera* Braun, type, ventral view. Cache County, Utah.

Plate XXIII

Female Genitalia

Fig. 117.—*Elachista irrorata* Braun, ventral view; 117a, ostium and sclerotized portion of ductus bursae further enlarged. Cincinnati, Ohio.

Fig. 118.—*Elachista oxytypa* new species, allotype, ventral view with ovipositor and bursa copulatrix omitted. Bradore Bay, Quebec.

Fig. 119.—*Elachista coniophora* new species, allotype, ventral view with ovipositor omitted. Colfax, Placer Co., Calif.

Fig. 120.—*Elachista adempta* nom. nov., ventral view with ovipositor omitted. Stockton, Utah.

Fig. 121.—*Elachista albella* (Chambers), ventral view with ovipositor omitted. Colorado.

Fig. 122.—*Elachista fuliginea* new species, allotype, ostium and sclerotized portion of ductus bursae (to same scale as Figure 117a). Ottawa, Ontario.

Plate XXIV

Female Genitalia

Fig. 123.—*Elachista excelsicola* new species, allotype, ventral view; *a*, group of teeth at inception of ductus seminalis, greatly enlarged. Mt. Washington, New Hampshire.

Fig. 124.—*Elachista albicapitella* Engel, ventral view with ovipositor omitted; *a*, teeth at inception of ductus seminalis, greatly enlarged. Cincinnati, Ohio.

Fig. 125.—*Elachista nitidiuscula* new species, allotype, ventral view with ovipositor omitted; *a*, teeth at inception of ductus seminalis, greatly enlarged. Cincinnati, Ohio.

Fig. 126.—*Elachista leucofrons* Braun, ventral view with ovipositor and bursa copulatrix omitted; 126a, signum. Cincinnati, Ohio.

Fig. 127.—*Elachista stramineola* Braun, type, ventral view. Glacier National Park, Montana.

Fig. 128.—*Elachista sylvestris* Braun, paratype, ventral view; 128a, greatly enlarged section of ductus bursae showing opposing teeth at inception of ductus seminalis. Cincinnati, Ohio.

Plate XXV

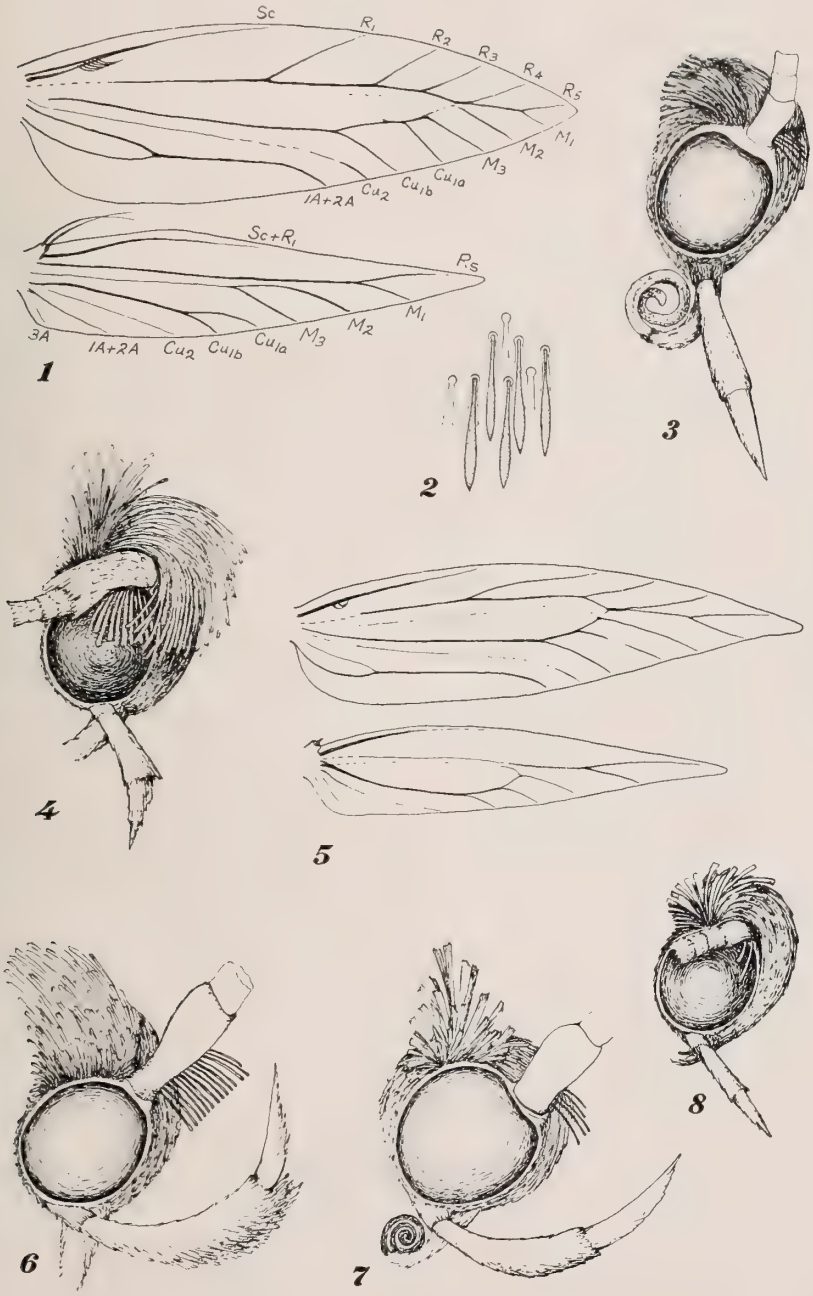
Female Genitalia

Fig. 129.—*Elachista inaudita* Braun, type, ventral view. Sparrow Lake, Ontario.
Fig. 130.—*Elachista cucullata* Braun, paratype, ventral view. Cincinnati, Ohio.
Fig. 131.—*Elachista tanyopis* Meyrick, ventral view. Alton, Maine.
Fig. 132.—*Elachista maritimella* McDunnough, ventral view. Parrsboro, Nova Scotia.

Plate XXVI

Female Genitalia

Fig. 133.—*Elachista radiantella* Braun, ventral view; 133a, seventh tergite, showing area of insertion of knobbed hairs; 133b, knobbed hairs from tuft of seventh tergite, greatly magnified. Clermont County, Ohio.
Fig. 134.—*Elachista praelineata* Braun, ventral view; 134a, seventh tergite, showing area of insertion of knobbed hairs, with four denser tufts indicated; 134b, knobbed hairs from tuft of seventh tergite, showing close insertion, greatly magnified. Cincinnati, Ohio.
Fig. 135.—*Elachista madarella* (Clemens), ventral view; the setae fringing the dorsal posterior margin of the eighth segment represented by broken lines. Cincinnati, Ohio.
Fig. 136.—*Elachista enitescens* Braun, ventral view; setae fringing the dorsal posterior margin of the eighth segment indicated by fine broken lines. Cincinnati, Ohio.
Fig. 137.—*Elachista argentosa* Braun, ventral view; ovipositor removed to show the strong setae fringing the dorsal posterior margin of the eighth segment. Clermont County, Ohio.



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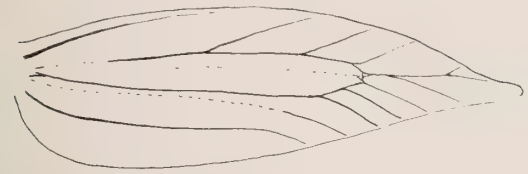

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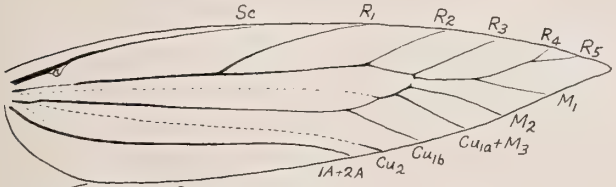

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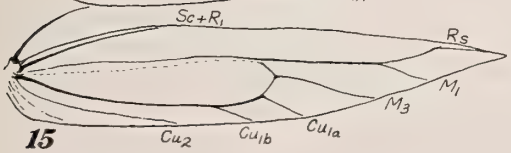

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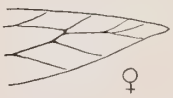

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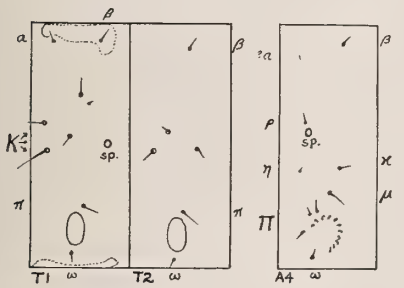

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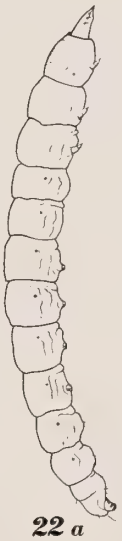

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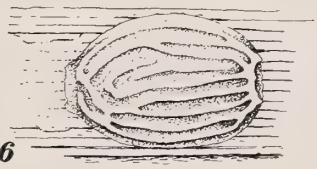

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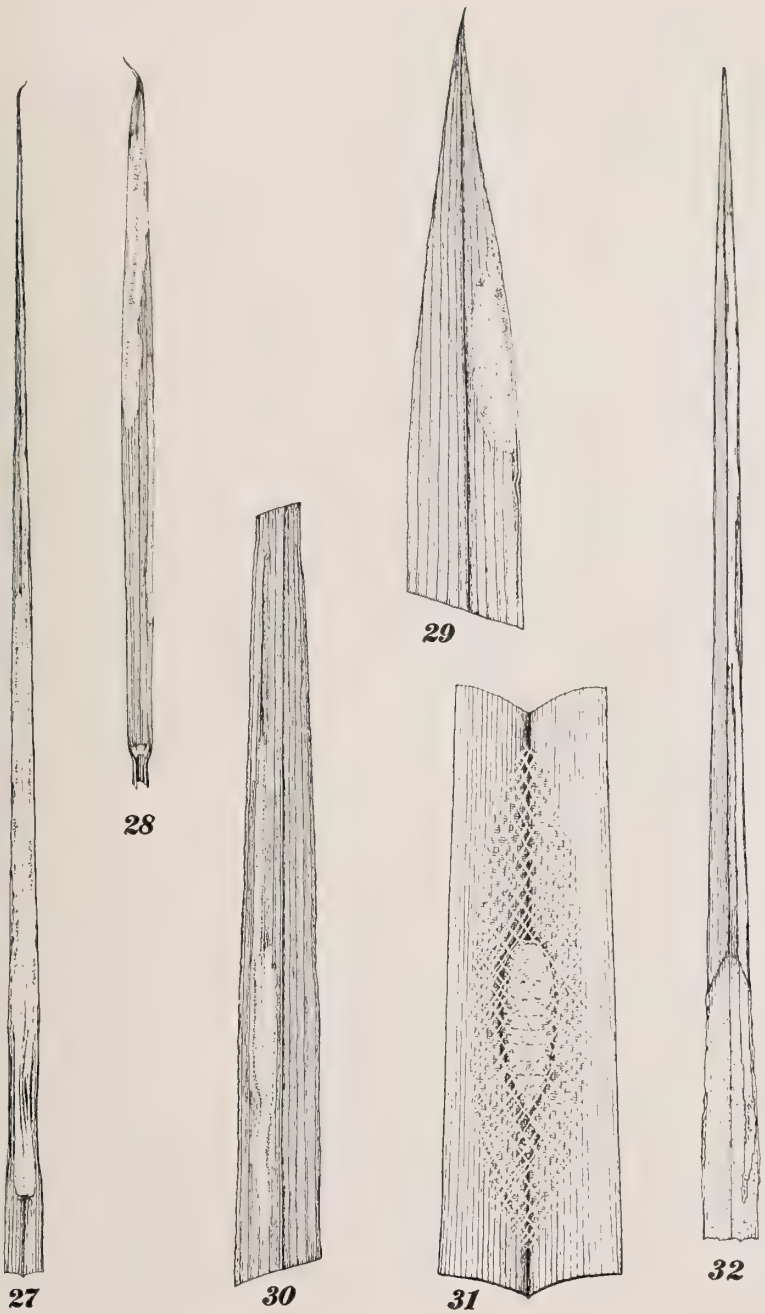

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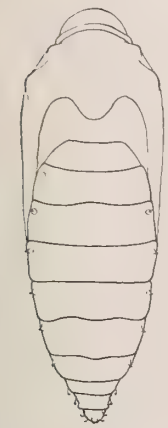

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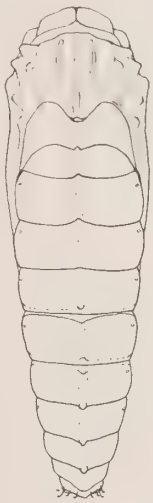

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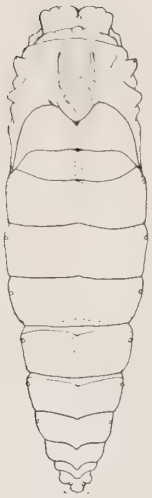

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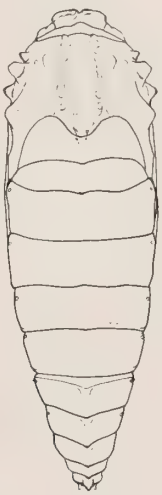

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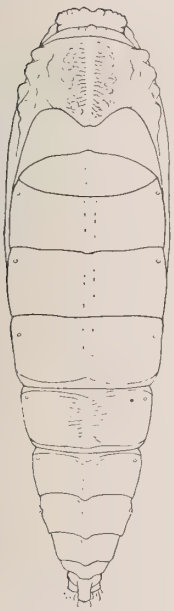

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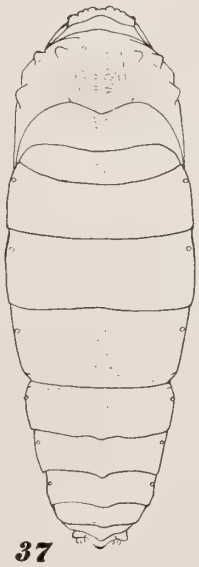

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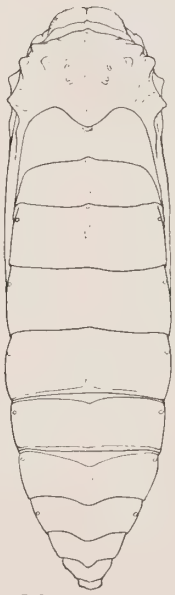

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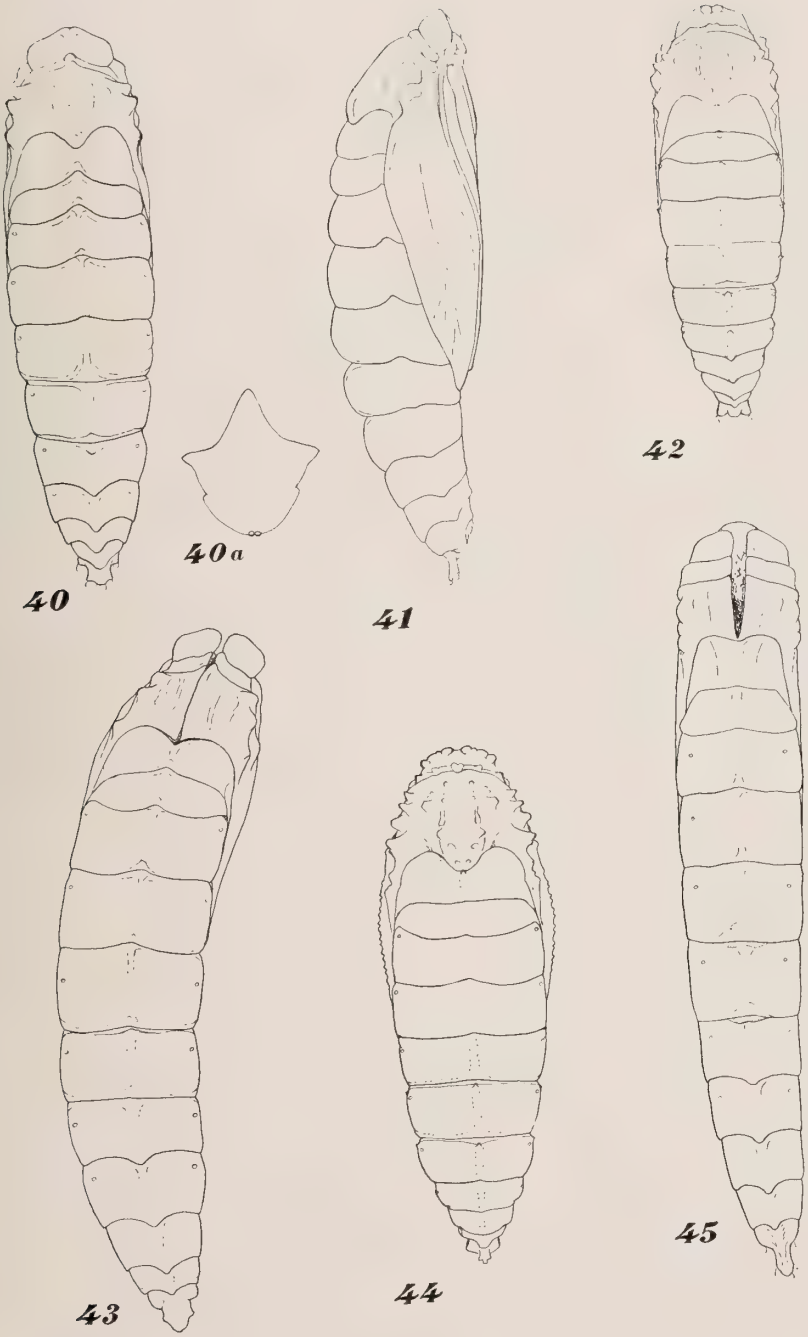

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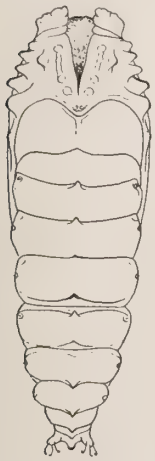

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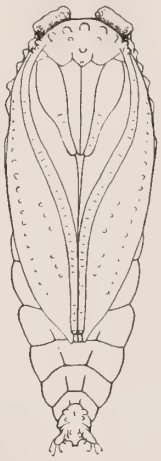

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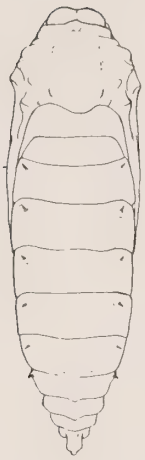

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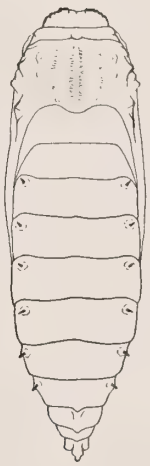

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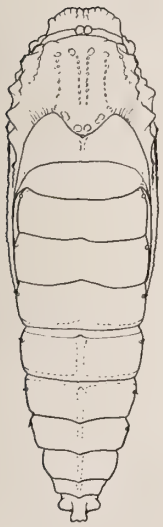

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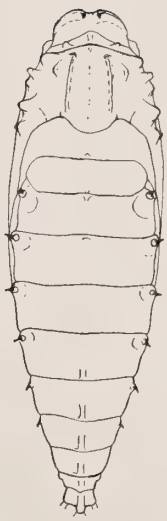

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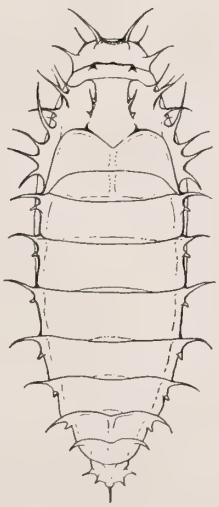

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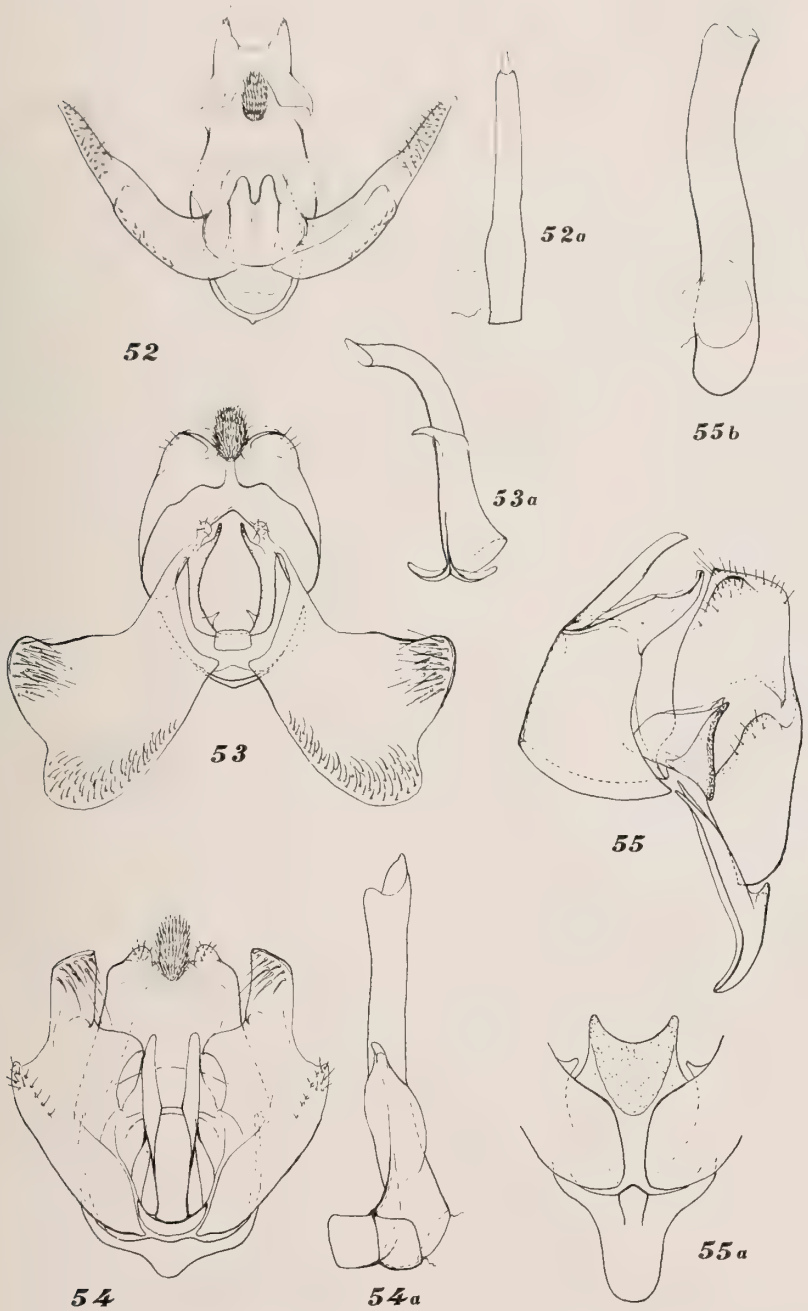
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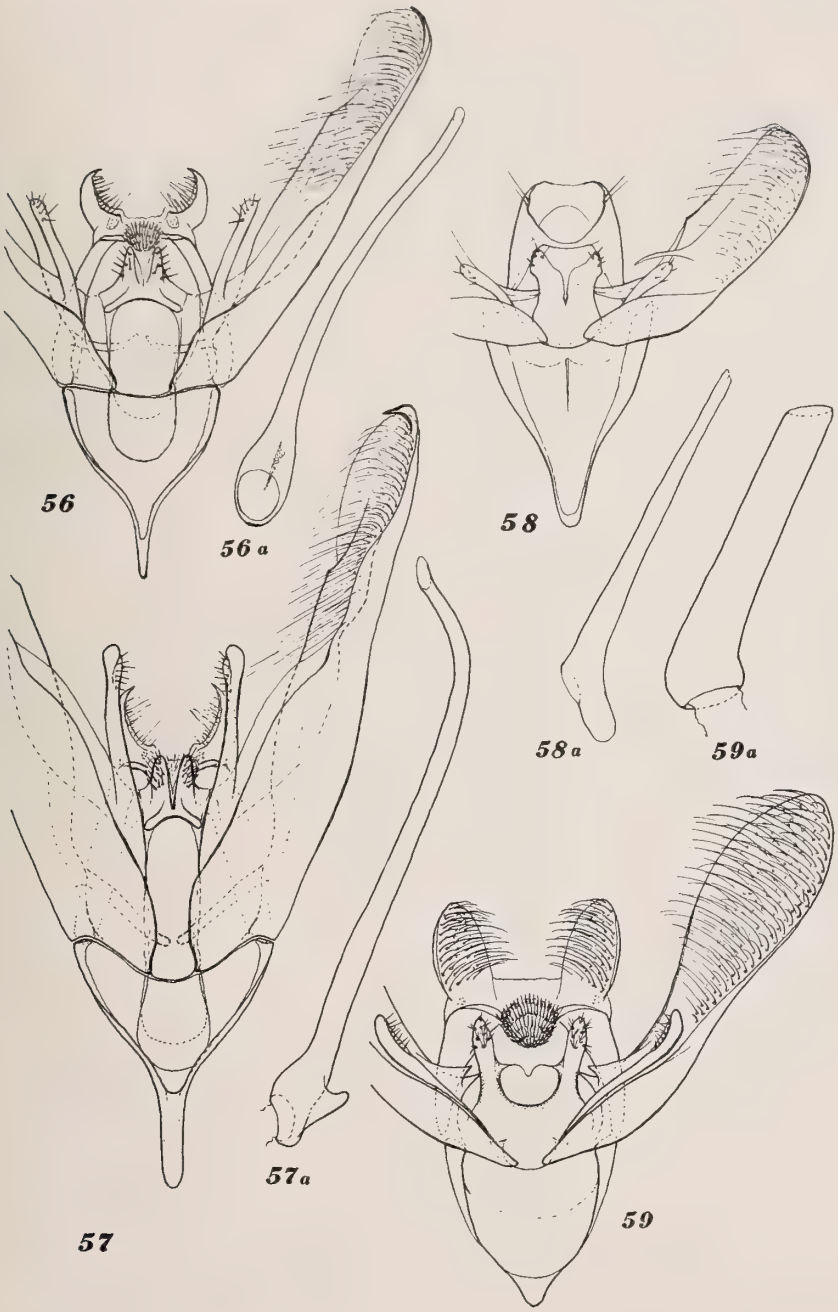

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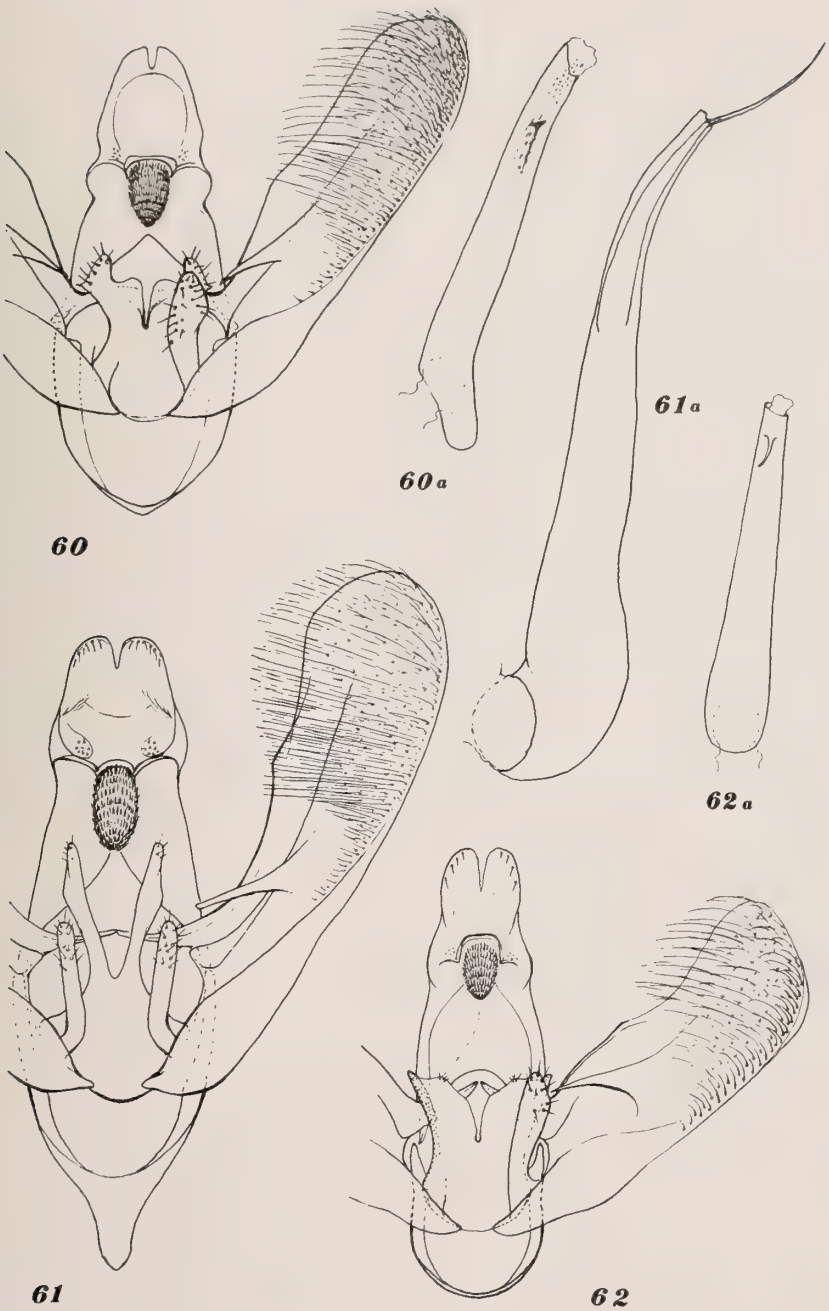

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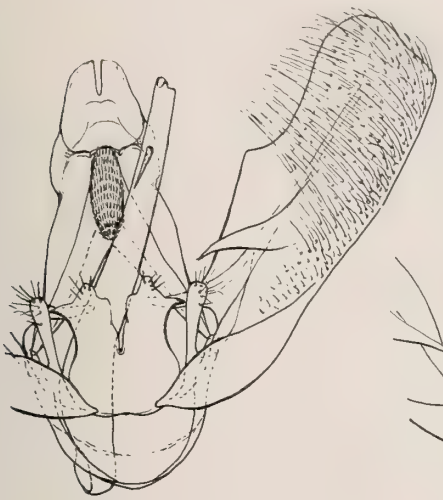

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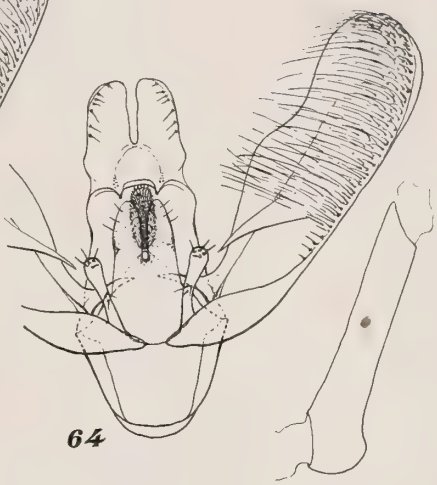

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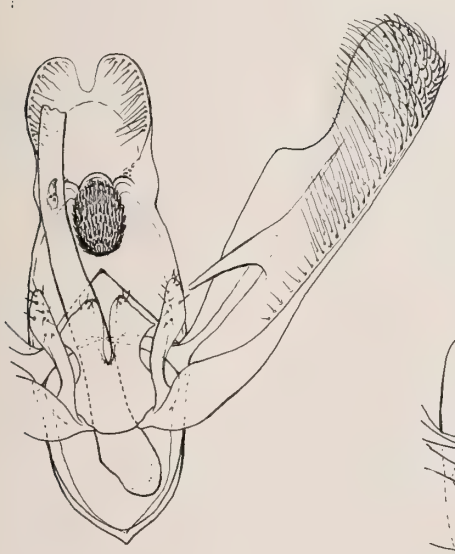

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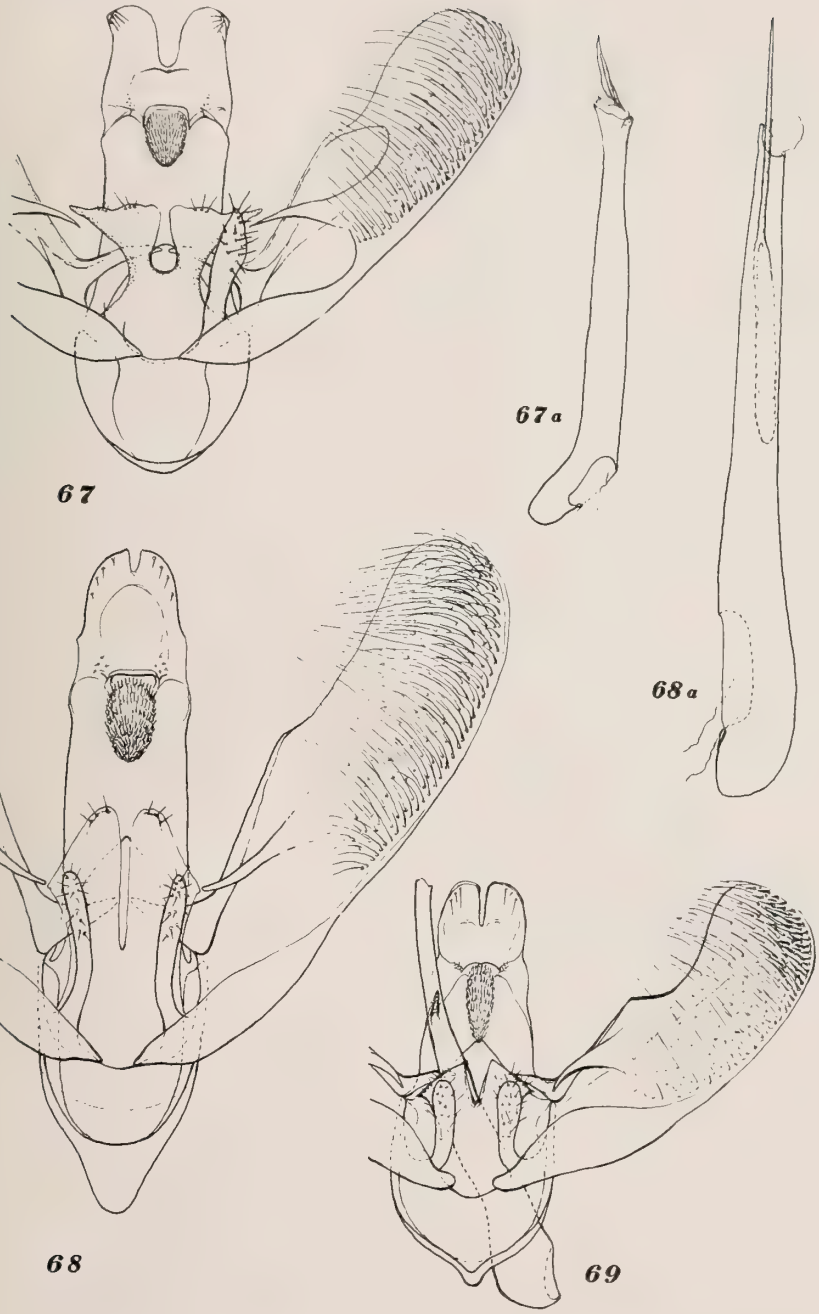

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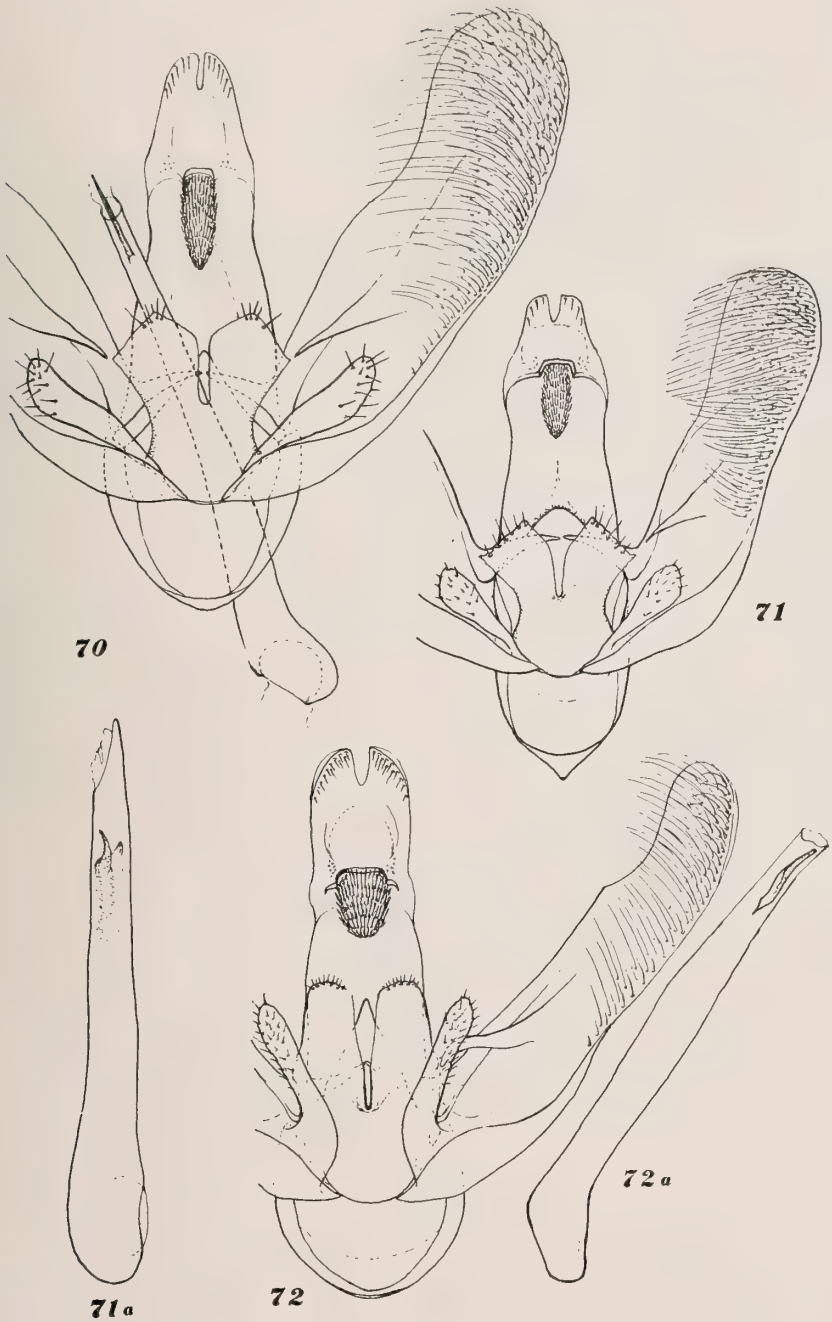

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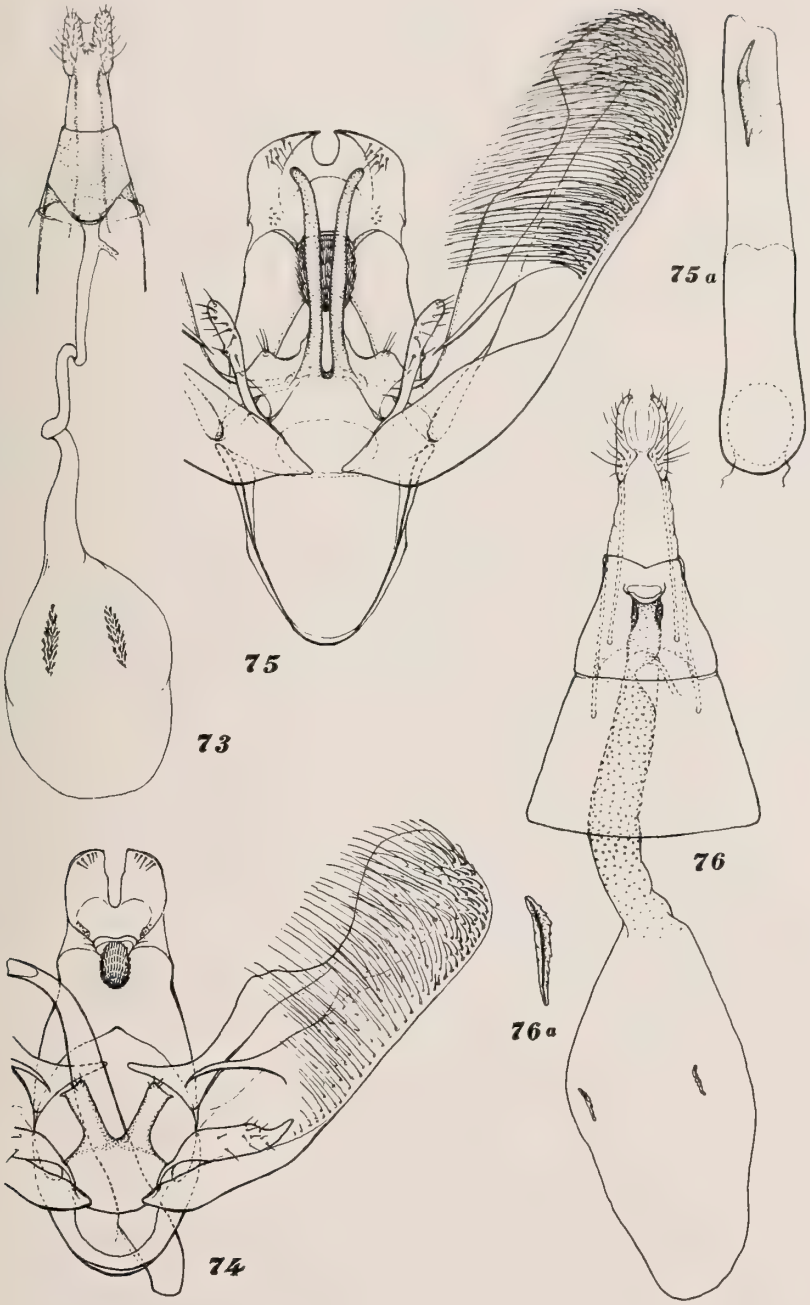

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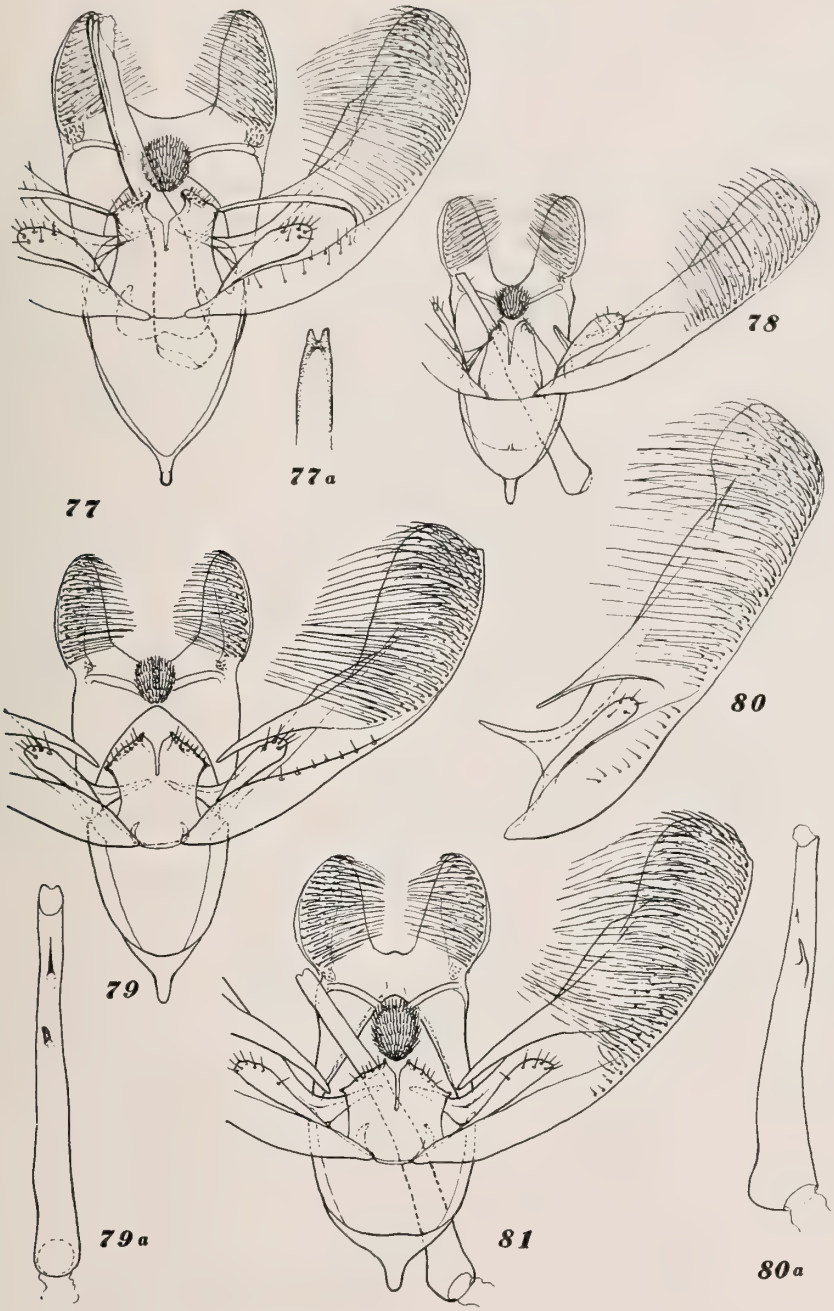

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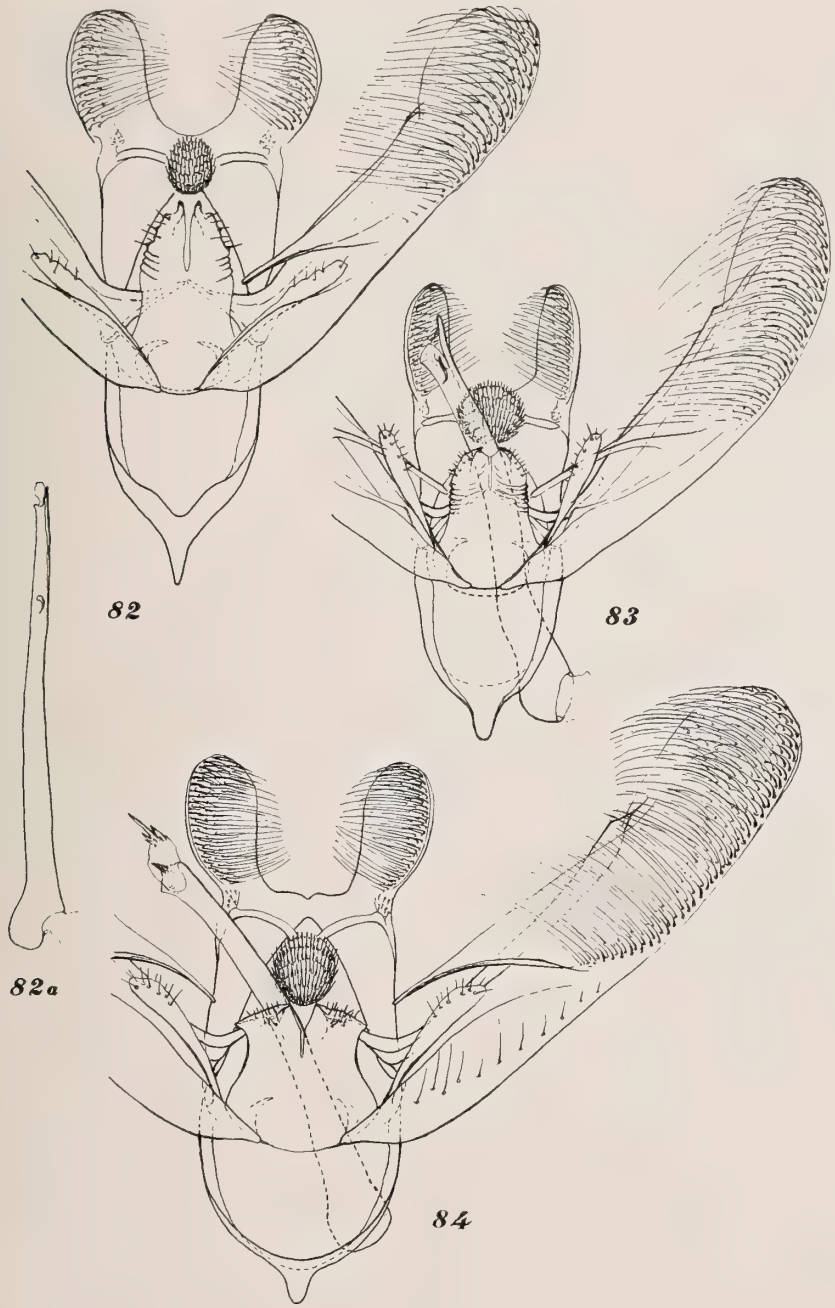

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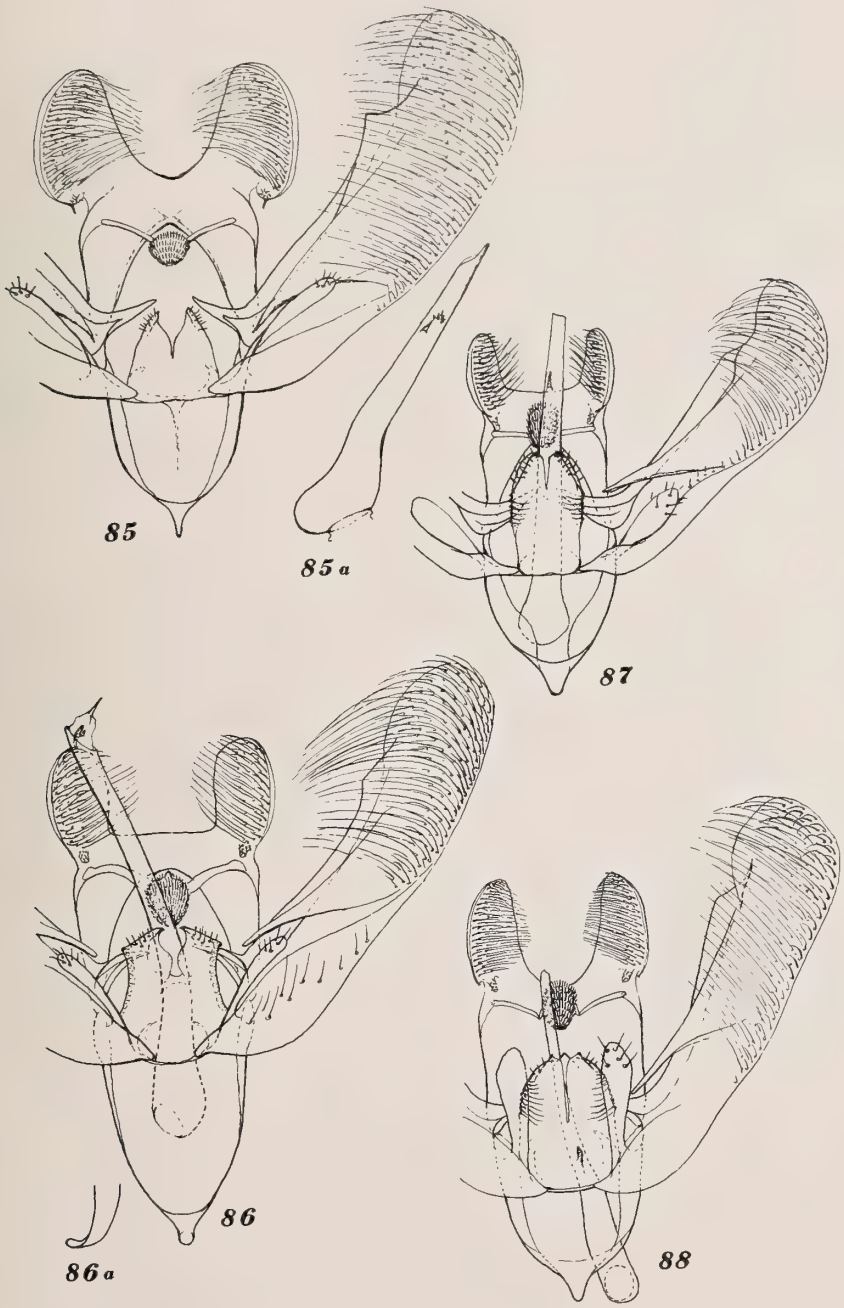

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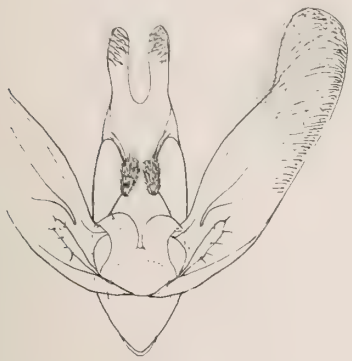

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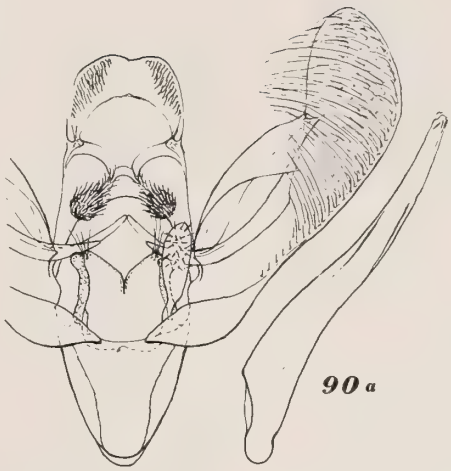

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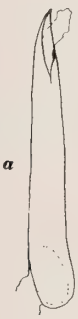

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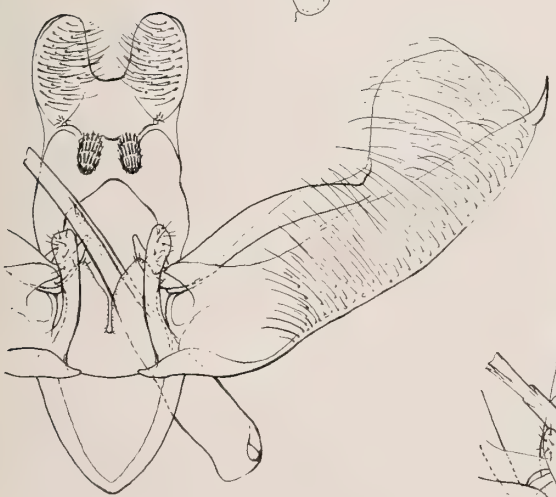

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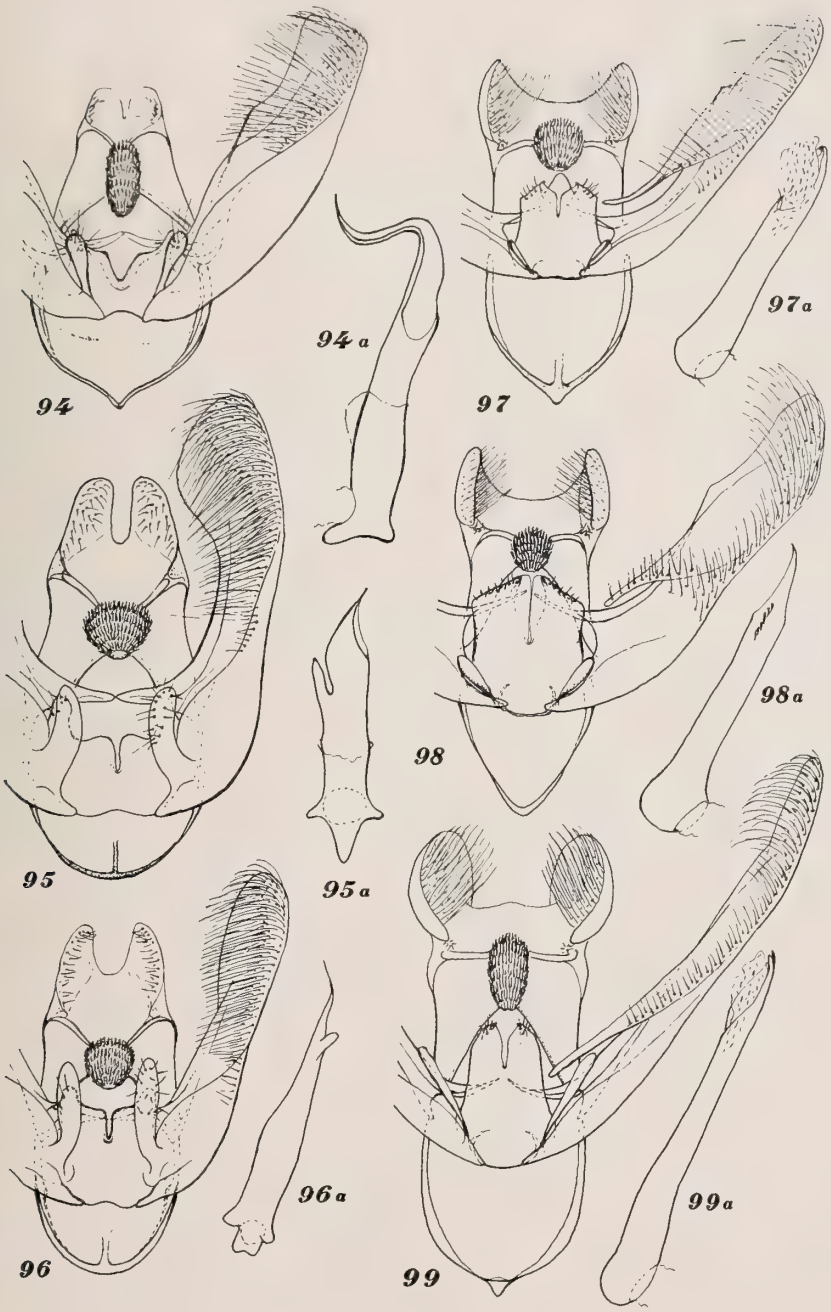

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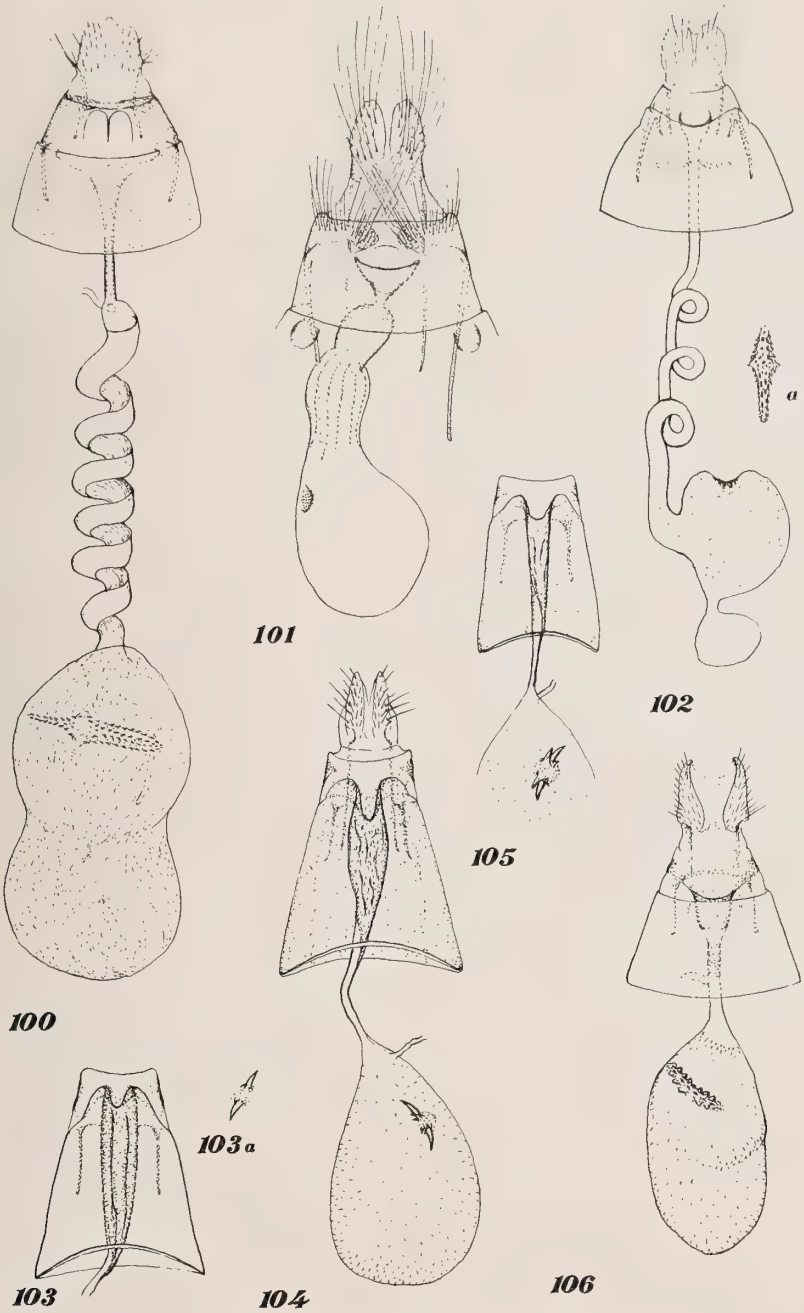

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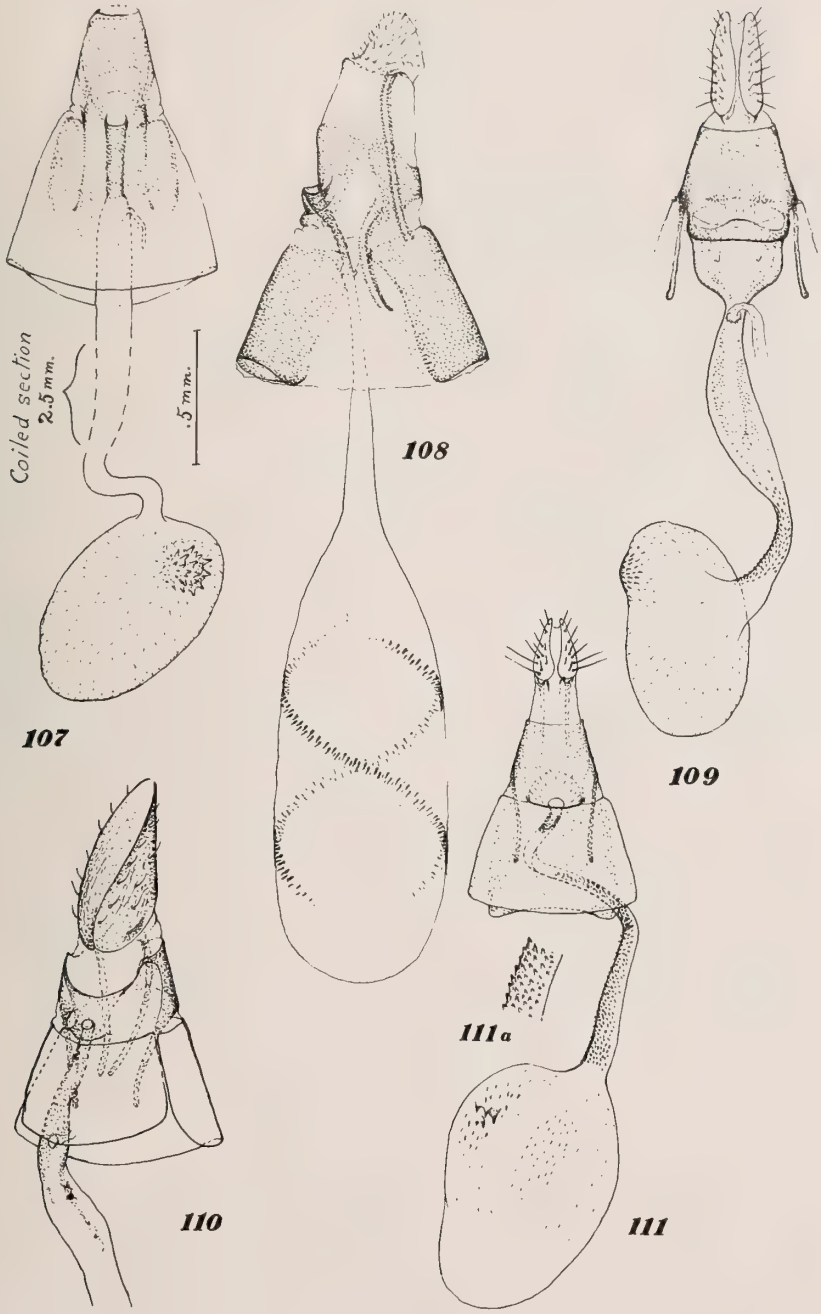

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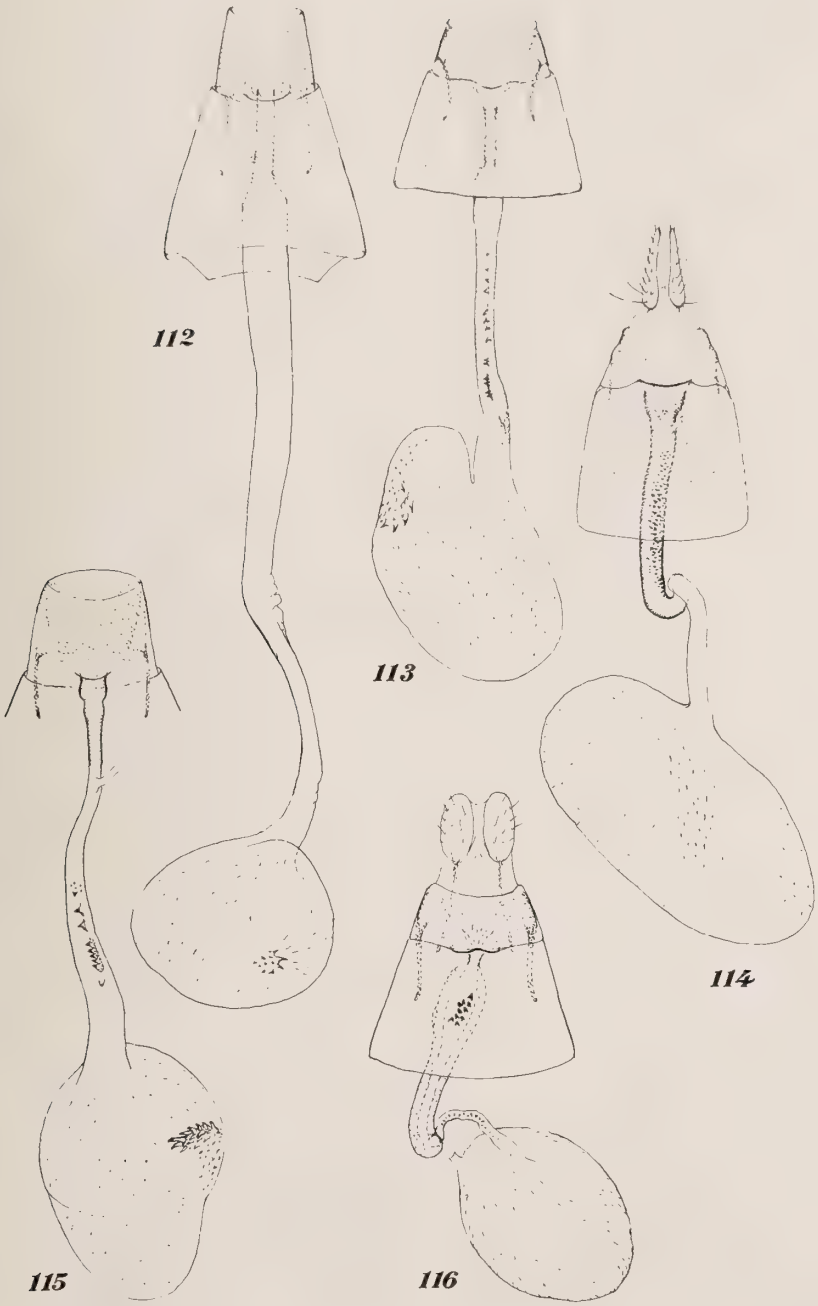

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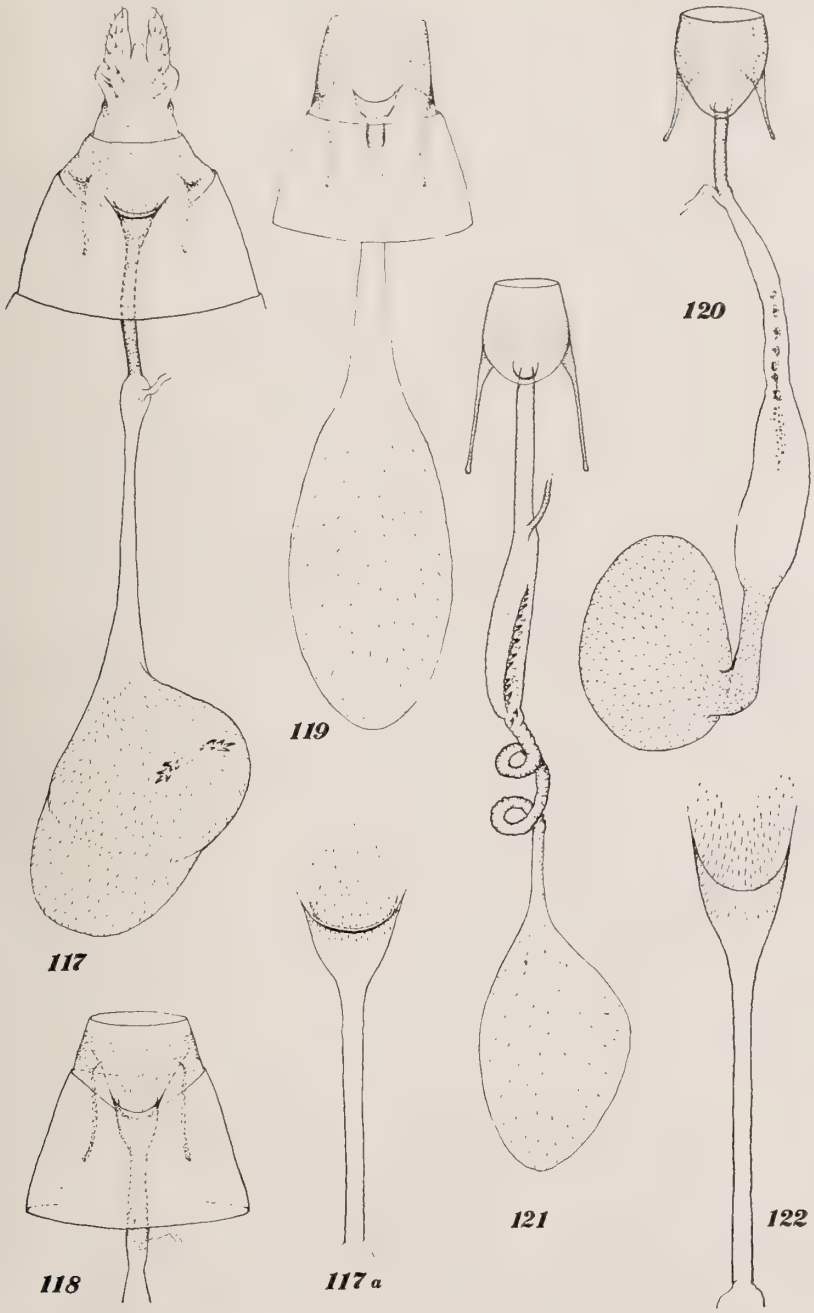

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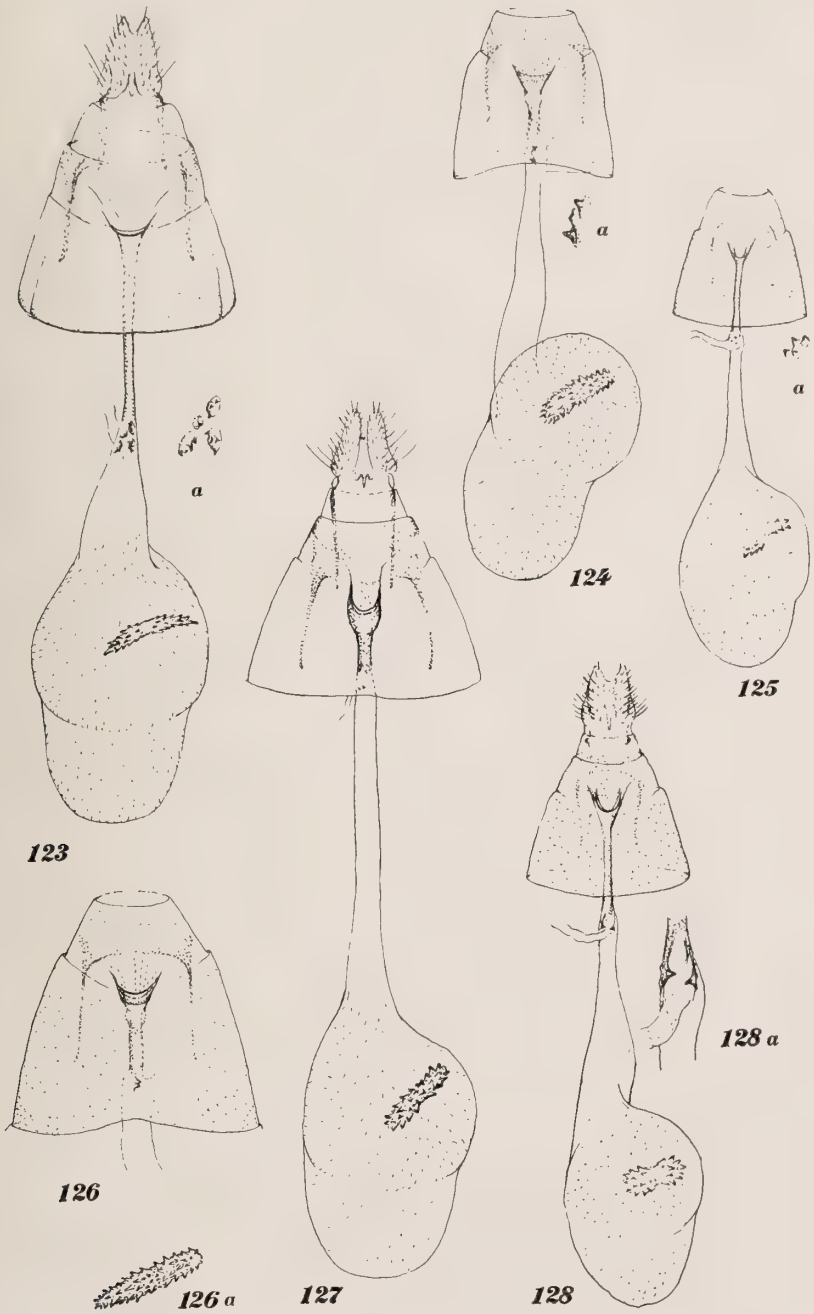

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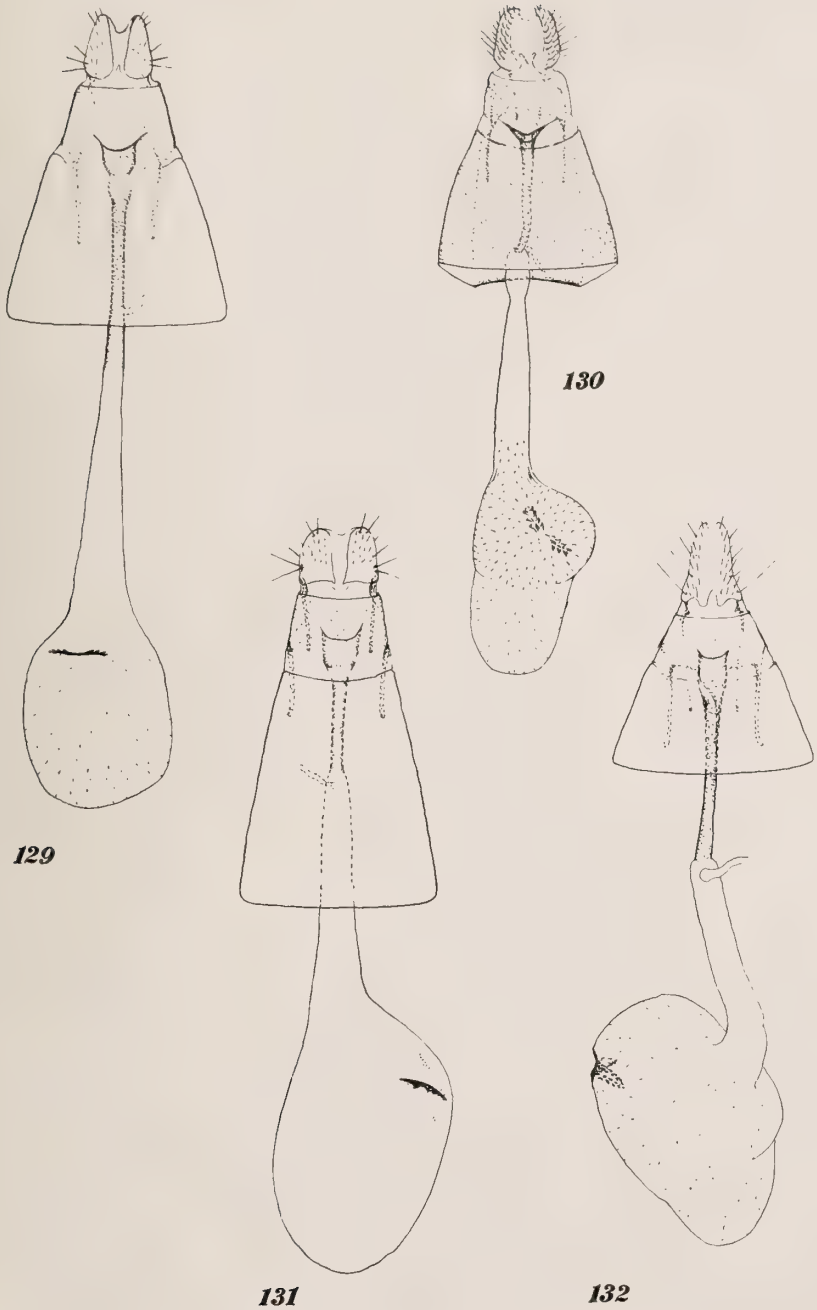

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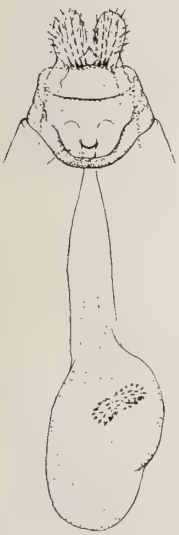

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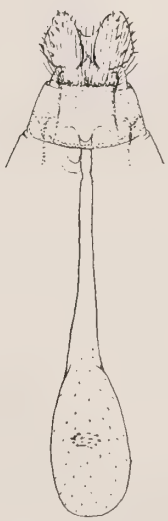

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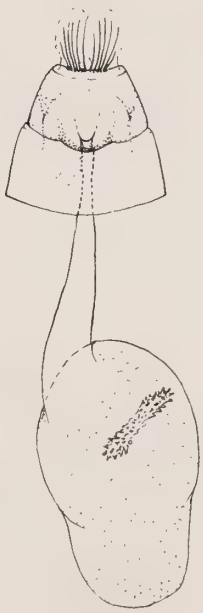

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